

Pi

To face the Tide.



A. Motte sculp.

He spake of trees, from the cedar-tree that is in Lebanon, even unto the hyssop that springeth out of the wall; he spake also of beasts, and of fowl, and of creeping things, and of fishes. 1 Kings 4:33.

Speſtacle de la Nature :
OR *170d*
Nature display'd.

BEING
DISCOURSES
On ſuch Particulars of
NATURAL HISTORY
As were thought moſt proper
To EXCITE the CURIOSITY,
AND
FORM the MINDS of YOUTH.

Illustrated with COPPER PLATES.

Translated from the Original *French*,
By Mr. HUMPHREYS.

The FOURTH EDITION, Corrected.

L O N D O N,

Printed for J. and J. PEMBERTON in *Fleet-ſtreet*;
R. FRANCKLIN, in *Covent-Garden*; and
C. DAVIS, in *Pater-noſter-row*.

MDCCXXXIX.

10

Jos: Banks

~~The amiable Qualities~~
~~which Nature has endow'd you~~
TO HIS
ROYAL HIGHNESS
THE
Duke of Cumberland.

S I R,

THE universal Approbation
which the several *French* E-
ditions of this Volume have re-
ceived, from Persons of the finest
Taste, furnished me with an In-
ducement to lay the following
Translation at Your Royal High-
nesses Feet.

DEDICATION.

The amiable Qualities, with which Nature has enriched Your Royal Highness, have been so happily cultivated by the best of Educations, that I am persuaded the wonderful Scenes of Providence, so elegantly displayed in this Treatise, will not be considered by Your Royal Highness, as an unpleasing Entertainment, unless I have been so unfortunate as to render it such, by a disagreeable Version.

As the Mind of Your Royal Highness has been watered with the purest Streams that Learning could dispense, and as you have long been habituated to those Institutions which render a young Prince the Darling of those who have the Honour to approach him, there

DEDICATION.

there is sufficient Reason to believe, that any generous Attempt to promote useful Knowledge, and inspire the Sons of Men with Gratitude to their great Creator, will obtain a favourable Reception from Your Royal Highness, whose Cabinet has ever been inaccessible to the low Singularities of Infidels and Sceptics.

The Worthy Author of the following *Conversation*, has charmed so many of the politest Readers, with his engaging *Display of Nature*, that I was ambitious of employing my small Abilities, in transfusing his Sentiments into the *English* Language; and should Your Royal Highness condescend to think I have not been altogether unsuccessful in my Attempt, I

A 3 shall

DEDICATION.

shall then have the Honour of
being indebted to you, for a Plea-
sure that will always be grateful-
ly predominant in the Heart of,

S I R,

Your Royal Highnesses's

Most Obedient

And Most Devoted,

Humble Servant,

Samuel Humphreys!

i

T H E

P R E F A C E.

OF all the Methods capable of being practised with Success, for cultivating the Understanding of young Persons, and giving them an early Habit of Thinking; there are none that produces more sure and lasting Effects than Curiosity. The Desire of Knowledge, is as natural to us as Reason, it exerts itself with Force and Vivacity through every Stage of Life; but never with more Efficacy than in Youth, when the Mind, being unfurnished with Knowledge, seizes, with a peculiar Eagerness, on every Object presented to it, resigns itself to the Charms of Novelty, and easily contracts the Habit of Reflection and Attentiveness.

We might receive all the Benefit this happy Disposition is able to produce, did we employ it upon Objects equally qualified to engage the Mind by Pleasure, and fill it with clear and instructive Ideas. This double Advantage is to be attained, in full Perfection, by the Study of Nature; whether we consider her Structure, and Assemblage in general, or take a Survey of her Beauties in particular. Through all her Works she

is qualified to please and instruct, because they are all full of Harmony and Contrivance. All the Bodies that surround us, the least as well as the largest, acquaint us with some Truth; they have all a Language, in which they address themselves to us, and indeed to us alone. We learn something from their particular Constitution, and their Determination to a certain End, points out the Intention of the Creator. The Relations they bear to one another, as well as to us, are so many distinct Voices that call for our Attention; and which, by the Counsels they give us, replenish our Lives with Accommodations, enrich our Minds with Truth, and warm our Hearts with Gratitude. In a Word, we may say, that Nature is the most learned and compleat of all Books, proper to cultivate our Reason, since she comprehends at once, the Objects of every Science, and never confines her Instructions to any particular Language, or People.

It is from this Book, lying open to every Eye, tho' very little consulted, that we propose to give an Extract, with the View of making young Persons sensible what Treasures they possess unenjoyed, and to present to their Observation those things, that Distance, Minuteness, or Inattention may have concealed from them. Instead of passing methodically, from general Maxims, and universal Ideas, to those that are more particular, we thought it incumbent on us to imitate the Order of Nature herself, and begin with the first Objects we perceive around us, and which are every Moment at Hand; we mean Plants, and Animals.

animals. We have begun with Animals of the smallest Bulk. From Insects, and diminutive Creatures, cloathed with Shells, we proceed to Birds, terrestrial Animals, and Fishes. After an Examination of Part of the Services they yield us, we pass to those we receive from Plants, with an Attempt thro' the whole, to mix Improvement with Variety. If we have not always confined ourselves to a scrupulous Regularity, it was because we think it allowable, in conducting the Mind to Truth, to expatiate out of the strictest Way, when we find it too rugged; and to strike into the most agreeable and amusing Track, if it equally leads us to the Place we wou'd arrive at.

But as it is not sufficient to give the Mind a Propensity to be inquisitive, by entertaining it with agreeable Scenes, unless, we likewise teach it to be moderate and cautious in its Curiosity; we have concluded this first Part with a short Consideration of the just Prerogatives, and necessary Limits of human Reason, its great Interest consisting in the Enjoyment of whatever is accommodated to it, without vainly pursuing what is not privileged to approach.

We have comprehended all these different Points, not under the Title of, The Natural Philosophy of Children; which wou'd have been very proper, had we only proposed to improve the most tender Age; nor under that of, General Physics; which promises too much: Our Design not being to offer any System in favour of those who have made much greater Advances: But we have

rang'd them under the Title of, *NATURE DISPLAY'D*; which only implies the Exterior, or what strikes the Sense, and expresses, with a sufficient Exactness, all of this Class that is granted to Mankind in general, is intelligible to every Age, and which no one can avoid being acquainted with to a certain Degree. We all enjoy Sight, and are conversant with the external Part of Nature. This View of it is for us, and in confining ourselves to it, we, in every Part, sufficiently discover Beauty, Instruction, and Truth. We are certain of the Existence of Objects; we see their Form, we experience their Goodness, we calculate their Number, we behold their Properties and Relations, their Tendencies and Use. Here is an ample Variety of instructive Exercise for the Mind. Every new Information is an additional Pleasure. We see our Riches increasing with our Discoveries, and the View of so many Benefactions must needs banish Ingratitude and Indifference from our Hearts. But if we desire to fathom the very Depths of Nature, to trace Effects up to their particular Causes, and comprehend the Curiosity and elastic Play of every secret Spring, as well as the minutest Element that compose them, this is an arduous Attempt, the Success of which is very uncertain, and we leave it to those transcendent Geniuses who are permitted to behold and enter into those Mysteries. For our Part, we think it better becomes us to content ourselves with the exterior Decoration of the World, and the Effect of those Machines which constitute the Prospect. Here we have
Access,

P R E F A C E.

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Access, and may even see, that it was arrayed with so much Splendor, in order to excite our Curiosity. But then, satisfied with a Survey that abundantly fills our Senses and Imagination, it is not necessary we should require the secret Pavilion of these Machines to be unfolded to our View. In a Word, 'tis our Province to select, out of the Scene of Nature, all that can give us lively Impressions, and exercise our Reason to Advantage, without ever touching upon those Points which seem above the Reach of that Faculty, or even upon those that would easily weary its Efforts.

As to the Model of the Work, we have endeavoured to exclude from it whatever might seem disagreeable; and instead of methodical Discourses, or a Chain of Dissertations, that frequently satiate and disgust; we have chosen the Style of Dialogue, as most natural, and proper to engage all Sorts of Readers.

Our first Thought, in the Choice of Interlocutors, was to have introduced some celebrated Characters. It gives one a sensible Pleasure to see great Men revive in Dialogue, and by an agreeable Allusion, we imagine ourselves Sharers in their Conversation, and are interested in what we believe we hear. But it is easy to observe, how inconsistent such a Choice would have been with the Design we propose to pursue. Had we intended to establish Maxims for the Regulation of Behaviour, or to criticise the Imperfections of Mankind, we might, with Success, have borrowed from History, a Set of Names well known, and

proper to render the Discourse more important. These Personages would be as entertaining in Dialogue, as they are in the theatrical Representations, in proportion to the Conformity of their Characters and Sentiments to the Account we find of them in History. But the Case is not the same, in Points of Investigation and Philosophy.

'Tis a very dangerous Attempt, to give Language to Des Cartes, Malbranche, or Newton, and to lend these great Men their Ideas and Views. 'Tis easy to declare, that we are preparing to introduce Gassendi and Rohault; or, in other Words, that we are attempting to revive their Knowledge, Sentiments, and Characters. But how can one be punctual to such a Promise? To think, and speak like them, we must be what they themselves were. Besides, they are Persons who are not easily accommodated to the Level of all Sorts of Readers. Their Conferences must be sublime, and have the Air of perpetual Dissertations, in order to preserve their due Similitude. We shou'd likewise gain no extraordinary Point, if we brought together some of our most celebrated Observers; and, I am afraid, that Aldrovandus and Goëdaert, Malpighi and Grew, Leeuwenhoek, and Swammerdam, would not be proper Persons to present to the Reader. As valuable as these Authors may be, their Names alone would not constitute the Success of a Dialogue; whereas those Characters which are less conspicuous, will always make themselves known and relished, if what they advance be profitable and correspondent to Nature.

After

After all, as our Intention is only to entertain the Minds of young People with a free Conversation, suited to their Abilities, without perplexing them with Characters too strongly marked, or indulging a Vein of Pleasantry that would have too much the Air of a Theatre, we judged it proper, without much Parade, and as it likewise appeared most natural, to chuse the Country for a Scene of Dialogue on the History of Nature; and, in order to introduce or vary the Subject, it seemed necessary to fix on Personages of different Conditions, some of whom might furnish out Conversation from their Knowledge and Experience, and others render it engaging by their Curiosity.

Beside this, there is a greater Advantage than at first may be imagined, in throwing the Sciences into the Discourse of polite People who are conversant with the World, such as Chance every Day assembles, and such as Friendship, or a Similitude of Taste selects. And tho' these Characters give us, at first, less favourable Preventions than we receive from illustrious Names, yet, in the Event, we accommodate ourselves to them the better, because our Faculties need not make any extraordinary Efforts to understand and follow them. Whatever they say, that appears curious and new, affects us with stronger Impressions. We find ourselves touched with an agreeable Pride, to hear such Things from our Equals: and, whilst we give them our Attention, fancy we are capable of thinking and amusing ourselves as rationally as they; and the secret Approbation we afford them, insensibly becomes

becomes a natural Allurement to imitate them. These are the Considerations that have regulated our Choice.

A Youth of Quality, whom we shall call the Chevalier du BREUIL, in the Vacation from his College Studies, and at a Time when his Father had taken a Journey, to make an advantageous Provision for his eldest Son, pays a Visit, in the Country, to a Gentleman who was one of their intimate Friends, and who employs, in the Study of Nature, the Abundance of Leisure he enjoys.

The Count de JONVAL, for that is the Gentleman's Name, discovering an extraordinary Penetration and Vivacity in the Son of his Friend, endeavours to cultivate in his Mind the Rudiments of a good Taste, and a Philosophy that should always prove advantageous to him. He associates into their Conversations, the Prior-Curate of the Place, a Man valuable for his Knowledge, and one whom a long Share of Piety and Politeness had rendered still more engaging. And as the Subjects of their Amusement were some of the most common Occurrences, which were no way necessary to be illustrated by learned Disputations, the COUNTESS had an Inclination to increase the Company. All the Remarks the young Gentleman hears on Things which he had till then beheld with Inattention, are entirely new to him, and he never fails, at his Return from Hunting or Fishing, with which the Day closes, to commit to Writing all he can remember of the Conversation; after which.

which he gives his Journal to the Prior, for his Revisal and Correction. The Reader may suppose, that this Journal of their Conference, so modelled and retouched, is what we now offer to the Publick.

If these Amusements or Studies, in vacant Hours, have the good Fortune to be pleasing to Youth, and especially to the Youth of our Nobility, who, as they are frequently in the Country, are more conversant with natural Curiosities; we may hereafter renew these Entertainments, and endeavour, to the utmost of our Ability, to substitute a Taste for amiable Nature and Truth, in the place of the false Marvellous of Fable and Romance, that now revives in an hundred new Forms, notwithstanding the Declension it was reduced to by the good Taste of the last Age.

What Labour soever we have been at to be informed, either by our own Diligence, or the Friends we could confide in, of most of the Remarks on Nature advanced in these Conversations; we have still been careful to cite, in the Margin of every DIALOGUE, the most celebrated Authors, who have made the like Observations. We did not think it necessary to make use of what the Ancients have published upon some of these Articles, too often with more Credulity than Exactness; but the Reader will be more disposed to relish what he finds warranted by the Testimony of modern Observers, who have gained universal Reputation by their Accuracy and Circumspection.

The

The Works to which we have had chief Recourse, for our own Information, and to justify our Remarks, are the excellent History and Memoirs of the Academy of Sciences; the Philosophical Transactions of the Royal Society at London abridged by Lowthorp; the Tracts of Malphigi, Redi, Willoughby, Leeuwenhoek, Grew, Nieuwentit, Derham, Valisneri, &c.

As we have been solicitous to intersperse, in the second and third Volumes of this Work, those Illustrations, which some Passages in the first may require, those who have purchased the second Edition of this, will have no Occasion to buy the third. We acknowledge, indeed, that, beside these necessary Improvements and Corrections, we have changed some particular Expressions, but they relate only to such Points, wherein any former Mistakes can neither be prejudicial or degrading. Having found, for Instance, in taking the Shell of a Lion-Pismire to Pieces, that the Particles of Sand which compose it, are not consolidated together, but were suspended by small Fibres of Silk, like the Beads of a Chaplet; we thought it proper to observe, that these Insects, as well as some Species of Caterpillars, that are preparing to divest themselves of their last Skins, in order to assume the Form of Aurelia's, cover themselves with a Surface of Sand, not by glewing the Grains of it together, by an Exhalation of Sweat, but rather by uniting them with a viscous Thread. Eight or ten Remarks of this Nature are not of any considerable Consequence, and add no extraordinary

traordinary Merit to a Book. We have, however, inserted them, that we might endeavour to be as accurate as possible; but have always been cautious not to lengthen, or multiply such Additions, since a Profusion of them would have appeared, to many of our Readers, rather perplexing, than explanatory or improving.

When we write for the Learned, we need not be apprehensive of degrading ourselves in their Opinion, by the Minuteness of the Subjects we consider; nor of trespassing upon their Patience, by the Length of the Disquisitions, in which we engage; Truth, in all its Forms, is dear to such Persons, and every new Discovery is sure to obtain their Esteem. Readers of this Class, will undoubtedly be pleased with the Natural History of Insects, the first Volume of which has been lately published by Monsieur de Reaumur. They will there find exact Divisions, and the most inconsiderable Diversities peculiar to each Species. The Anatomy of Insects, with their Changes and Operations, are there treated with a Perspicuity, Copiousness, and Penetration, that leave nothing unexplained. But the Readers for whose Improvement we were solicitous, are far from expecting this Method from us: On the contrary, if this small Work has obtained a favourable Reception from the Public, that Happiness results from the Accommodation of Materials to the Capacity of young Persons, and chiefly from the Preference we have constantly

stantly given to such Particulars, as could either touch or instruct them, with relation to what would otherwise have proved a cold and unproductive Branch of Knowledge. We may add, that the Advantage which arises from this Precaution, is not to be limited to Youth alone, since Persons of all Ages and States of Life, are desirous of being affected with pleasing Impressions, and to have their Imaginations filled with the Wonders which are constantly exhibited around us by the Deity, in the least as well as the largest Objects. The most inconsiderable Parts of Nature may, by these Means acquire an Air of Dignity and Spirit, and when they can once be rendered engaging, we regard them with Attention and Complacency: But they would immediately shrink into their original Minuteness, and appear more despicable than ever, to the Generality of Readers, should they make them the Subjects of a long and dry Series of Study. Had we proceeded in this Track, our Book would have been rejected with this Reproach, that we treated the inconsiderable Miniature of Nature in a scientific Manner. This Censure we were unwilling to incur, and have therefore been careful not to crowd this Edition, any more than the former, with a Multitude of Particulars, especially in the Article of Insects; and if this Edition should be thought preferable to the preceding, it may possibly owe that Merit to some Retrenchments that have been made in more Places than one.

As to those Plates that were either too much worn, or insufficient for our Purpose in any other Particular, it has been thought necessary to substitute new ones in their stead. Such for Instance, are the Solomon in the Frontispiece, engraven by Monsieur Cochin; the Papilio's of Day, and those of Night, engraven by Madam Cochin; the large Wasp's Nest taken from Nature, by the same Hand; to which we may add, the Gnats and other Insects; together with the principal Species of Fish and amphibious Animals, &c. Those who are desirous of inserting them in the former Editions of this Work, may purchase them of the Booksellers at a very moderate Expence, which these Plates have unavoidably occasioned.

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2. The Mouth and Spinners. C. One of the
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H. The Trunk open. I. The Chrysalis. K. The young Wasp almost formed.

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Gnats and other Insects.

A. The Chrysalis produced by an Aquatick Worm. (a) The Tail lubricated with Oil, and resting on the Surface of the Water, while the Chrysalis rears its Head into the Air, or keeps it suspended in the Water. B. The Gnat, sprung from that Chrysalis, which before enclosed it, (1) The Head and small Plumage. 2. The Antennæ, or Horns. 3. The Trunk that unsheaths the two Darts. A. The Sheath from whence the Darts are launched through a lateral Overture. 4, 5, 6, 7. Different Forms of Darts, which are either all shot out at the same time, or separately. The whole appears in the Magnitude exhibited in a Microscope. C. The Dragon Fly magnified. D. The two Eyes of the Insect. E. A Mite as it appears in a Microscope. F. A Pismire magnified. G. The Mole Cricket, in its natural Dimensions, and from under whose scaly Coat two little Wings are expanded. This kind of Tail, which extends to the Extremity, are two other Wings folded up. H. A Flea as it appears in a Microscope. (a) The three Points which
rise

rise out of the Head, and of which that in the middle serves as a Trunk for the Suction of Blood. (b) The long Paws, by whose Elastick Spring the Creature darts along. (c) The Egg of a Flea at large. (d) The same Egg, bruised by the Worm that springs from it. (e) The Worm which contains the Flea. (f) The Chrysalis divested of its Vermicular Skin, and which performs the Function of a Sheath, in which the Paws of the enfolded Flea are visible. This Formation which is so analogous to many others, and so regular in the minutest Animals, is a Demonstration that Chance has no Agency in Nature; but that every Part of her Works are measured out and completed by a wise Design.

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A. The Lion-Pismire larger than the Life. B. The Lion-Pismire hid in the Sand at the Bottom of his Ditch, and whirling the Sand on an Ant to prevent its regaining the side of the Ditch. C. The Ball of Sand in which the Lion-Pismire is changed into a Chrysalis. D. The Chrysalis at large. E. The Nymph that proceeds from it. F. An Aquatick Animal out of which springs another kind of Nymph.

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A. A Snail. B. The little Shell as it comes out of the Egg. C. The Collar and musculous Skin, by the Aid of which the Snail marches forwards. D. His four Telescopes. E. Several Fractures made in divers Snails, and which have been repaired by their Sweat. F. Several Shell-Fish whose Channels, Protuberances, and Spots, correspond to the Channels, Tumours, and different Perforations of the Body, which forms them by successive Advances of Growth.

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A. A Bean laid open. 1. The two Lobes containing the first Nourishment of the Bud. 2. The little Plant or Bud. 3. The little Root. 4. The Fibres of the two branched Tubes that are tending to unite together at the little Root. B. An Acron in its Cap. C. The Root of a little Oak rising first upwards, and then bending to the Earth. D. The little Root of a Bud, at first forced to ascend

ascend by meeting with some hard Body, and then turning downwards to the Earth; as it is seen in E. F. The Bud of a Gourd, as it appears through a Microscope on the Top of the Kernel. 5. The seminal Leaves clapped together, and containing the little Plant. 6. The little Root. 7. The seminal Leaves and little Root beginning to grow in the Seed. 8. The seminal Leaves sprouting out of the Earth. 9. The Root fortified and extending its Fibres in the Earth. 10. The little Plant beginning to shoot out its proper Leaves from between the two seminal Leaves; one of which is bent down in 11. G. The Kernal of an Orange which contained two Buds, and has shot forth two Stems. 12. The seminal Leaves. 13. The Lobes of the Kernel which are become useless, and are rotten in the Earth.

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A. The Fibres of the Wood. B. The Meshes thro' which the Rounds of the *Utriculi*, or little Bags pass. C. The Rounds of little Bags placed horizontally. D. The Air-Vents, always empty, of an equal Bigness, and composed of spiral Fibres. E. Transverse Fibres, which make the Wood hard to split, and terminate in the Knots, the Buds, and the Pedicles of the Leaves and Fruits. F. The Trunk of a young Tree of two Years Growth cut horizontally. 1. The *Epidermis*. 2. The gross Bark. 3. The fine Bark. 4. The sappy Part, or the Wood of the last Year. 5. The Wood of the first. 6. The *Utriculi* of the Pith. 7. The *Utriculi* that go from the Bark to the Pith. G. Part of the Inside of a Vine-Branch cut horizontally, and shewing the Orifices of the Vessels from one side of the Bark to the Pith. 8. The Place of the Bark which is taken away. 9. The three Rows of *Utriculi*, two of which go to the Pith. 10. The third ends in the Thickness of the Fibres. 10. The *Utriculi* of the Pith, larger than the horizontal ones. 11. The Orifices of the Vessels cut, which are the Fibres, the proper Vessels, and the Air-Vents; the largest Openings are those of the Air-Vents.

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1. A Tree planted on a Level.
 2. A right Angle.
 3. A Tree planted on a Declivity.
 4. An acute Angle,
- or

or narrower than a right one. 5. An obtuse Angle, or wider than a right one. A. An open Flower. 1. The Petals or Leaves of the Flower. 2. The Pistil, the Top of which is a long Pipe, and its Bottom in the Heart of the Flower is a Capsule containing the Seed. 3. The Tops containing a resinous Dust, they are sustained by the Threads or Chieves. B. The Tulip, with its Chieves higher than the Pistil. C. The Crown Imperial. 4. The Tops. 5. The Pistils longer than the Chieves. D. The Lilly, with its Pistil longer than the Chieves. E. One of the Pistils that cover the Bottom of the Sunflower, containing one Seed towards the Bottom. 6. A brown Bag full of a yellow Dust. 7. The Tube of the Pistil perforated with several little Holes. 8. Part of the little Bell that encompasses the Bottom of the brown Bag; this Figure shews it as it is by a Microscope.

All the Vessels are here represented larger than Nature.

I N S E C T S.

Sarah Bate 1789

I N S E C T S.

D I A L O G U E. I.

The Count de JONVAL.

The Prior de JONVAL.

The Chevalier du BREUIL.

Count. **I**F we intend to take our usual Walk, it is time to prepare for it. It grows late: Let us be gone.

Chevalier. Here's the *Prior* come very seasonably to make one of the Party.

Prior. Gentlemen, I invite you to take the Air, and amuse yourselves in the Garden: we must turn the Chevalier out of this Closet, where I always find him. Would not one be apt to say, it was some Post given him to make good?

Chevalier. I am always uneasy to leave it: The Count has filled this, and the two next Apartments, with so many Curiosities, that one can never be tired with beholding them.

Count. Do you think so, Sir? No: *Paris*, from whence you come, is the Place where you must look for Objects to please your Eyes: Here you will meet with nothing but plain Nature.

Chevalier. She is a thousand times more engaging than all the Glitter and Gildings of *Paris*. We are soon weary of seeing always the same things, but here is a surprizing Variety: I believe there is nothing brought from the four Quarters of the World, but what may be seen in this

B Place.

Place. The Count among other Things, must needs have collected Animals of every Species one can imagine. Some of them are of Nature's Creation, perfectly well dried and preserved, others are to be seen here in Pictures at least. But nothing gives me more Pleasure than this Multitude of little Creatures, who are living; some are working in the Window under a Glass Hive; others spin, or employ themselves after their manner, in crystal Vessels. How delightful is it to live in the Country! It daily produces something new.

Count. Every Person has a particular Manner of thinking: the Army, and the busy Scenes of Life, have taught me to value Retirement; it pleases me, and has made me pass a great deal of my time very much to my Satisfaction; this Variety of Amusements renders it agreeable, and I may even say advantageous to me; but a Gentleman of your Age has seldom an Inclination to enter upon the Anatomy of an Insect; and such Objects as Butterflies, and Silk-Worms, Ants, and Bees, must be very languishing Entertainments, for Eyes like yours.

Chevalier. Since you have made me acquainted with the Use of magnifying Glasses, I have seen admirable Things in Insects. The single Head of a Fly is covered with Flowers and Diamonds; the Wing of a Gnat, which, at the first View, looks like a small white Rag, and seems destitute of all manner of Beauty, appears, when you consider it attentively, as smooth as a Mirror, and glows like a Rainbow. I shall never be easy, 'till I have examined all the rest with the same Exactness.

Count. You design then to be a Man of Singularity. But tell me, Sir, do you meet with any one who amuses himself with the Study of Insects? We commonly destroy them, at least they are not much regarded. If you intend to regulate your Pleasures by mine, you will chuse a very unfashionable Model. To enjoy rational Delights, according to the gay Taste, a Man must be charmed with the Hurry of *Paris*, dress up to the Mode, fix his Choice of a shining Equipage with a great deal of Attention, and not forget the Accomplishment of a peculiar Snuff-Box; the Morning must be employed in writing down the Articles of a Collation, and, when that important Affair is dispatched, he must pass the rest of the Day in Visits, or Play; he ought

ought to relish the magick Feats of an Opera, and the frolick Dexterities of *Harlequin* at a Fair. These are your polite People, and this is the Turn of Mind which has nothing in it to be reproached. But to spend three Parts of the Year, like me, in the Country, and make the Study of the various Scenes of Nature one's Delight; to examine, for Instance, the Structure of an Animal's Body, to trace a Plant from its Original through all its Progress, and inform one's self, by repeated Experiments, of its particular Usefulness; I say, Sir, What do you think of this? Don't you find something very rustick in such a Life, and a great deal of the Cast of a dreaming Philosopher?

Chevalier. I conceive your Lordship's Meaning: you would give me to understand, that Men judge wrong; prize Trifles, and neglect what is truly fine and satisfactory.

Count. Since you enter into my Thoughts so justly, I will talk to you without Reserve. The View of Nature enchants me, and I find new Pleasures in it every Day, even with respect to the minutest Objects. Let us not begin with surveying those immense Globes of Fire that roll above us, nor this Earth which unfolds so many Treasures to our View. Let us first consider the smallest Objects, we may afterwards ascend by Degrees. The Scene we behold is truly magnificent, but that which our View cannot take in at once, we may divide and enjoy by Parts.

The Design
of the Work.

Let us begin with these Insects, so much despised by others, but of which you are so fond of. I assure you, they infinitely delight me by their Variety, their Dispositions, their Policy, and the wonderful Proportion of their Organs, as well as by a hundred Curiosities I observe in them. If the Deity did not think it unworthy of himself to create them, is it beneath us to consider them? But when we examine them in a nearer View, they afford us infinite Matter of Astonishment. Judge, then, Sir, by what is most obvious and familiar to our Observation, how much that which lyes concealed from our Eyes and Reason, would surprize us, were it divested of its Veil.

Insects.

The Definition and Division of Insects.

Every Insect, whether it flies or creeps, is a little Animal, composed either of several Rings, which shrink from or approach one another in a common Membrane that collects them; or else of several distinct Scales, that slide over one another; or lastly, of two or three principal Parts, connected by a Thread they call a Ligature.

Of the first sort are all Worms, as well those who have Feet, as those who are without them. When they would pass from one Place to another, they dilate the musculous Skin that separates the first Ring from the next. They advance the first Ring, whether it be near the Head or Tail, to a certain Distance; and then, by contracting and expanding the Skin of that Part, they move the second Ring; the same Effort draws the third, and so the whole Body marches in Succession. In this manner those little Animals, even without Feet, move and transfer themselves where they please; rise out of the Earth, and retire into it, at the Appearance of the least Danger, and advance and retreat as Need requires.

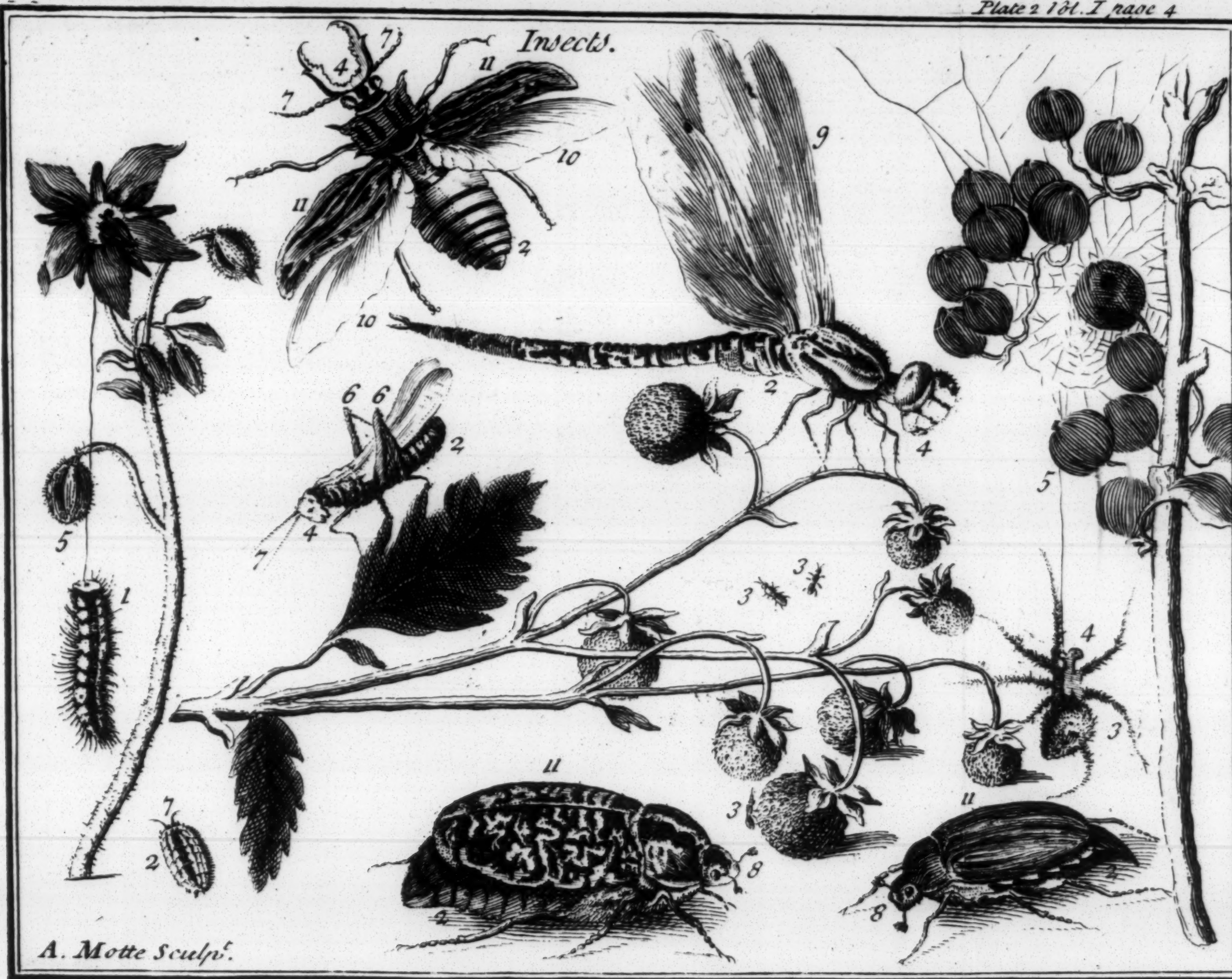
Of the second sort are Flies, and *May-birds*, besides an infinite Variety of others, whose Body is an Assemblage of many little Scales, which dilate by unfolding themselves, or contract by sliding over one another, like Brassets or Cuisses, in our old Suits of Armour.

Chew. Your Lordship has shewn me several of them in your Wardrobe.

Count. Of the third sort are Ants, Spiders, and several others, that you see divided into two or three Parts, which hardly appear to be connected with each other. It should seem that the Term *Insect*, which is appropriated to all these separate Parts, Sections and moving Rings, is derived from a *Latin* Word which signifies *to cut*, and is applied, in general, to all these little Creatures.

Insecare to cut.

Prior. Their Minuteness seems, at first View, to justify the Contempt we entertain of them: but, in reality it affords us fresh Reason to admire the Art and Mechanism of their Structure, which associates so many Vessels, Fluids and Movements, in a Point that is frequently imperceptible. Vulgar Prejudice considers them as the Effect of Chance, or the Refuse of Nature, but an attentive Eye discovers in



1 The Assemblage of Rings in one and the same Skin. 2 The Scales sliding over one another. 3 The Ligaments of Ants, Spiders &c. 4 The Teeth or Saws. 5 Insects suspended by their Thread. 6 The Springs of the Grass-hopper. 7 The Horns or Antennæ. 8 The Horns or Antennæ in the form of a Comb. 9 The Wings of a Dragon Fly. 10 The Wings of a Beetle. 11 The Case of the Wings.

in them a Wisdom, which, far from neglecting them, has been particularly careful to cloath, arm and accommodate them with all the Instruments necessary to their Condition.

This Wisdom has array'd them, even to a degree of Complaisance, by laying out such a Profusion of Azure, Green and Vermilion, Gold, Silver and Diamonds, Fringe and Plumage, upon their Robes, their Wings and the Ornament of their Heads. We need only behold the Ichneumon, *Spanish* Dragon, and Butterflies, nay a Caterpillar itself, to astonish us with this Magnificence.

The same Sagacity, which has been so liberal in their Ornaments, has completely armed and put them into a Condition of making War, and assaulting their Enemies as well as defending themselves. If they don't always seize the Prey they watch for, or escape what is prejudicial to them, they are at least furnished with the most proper Abilities for succeeding in their Designs. The Generality of them are provided with strong Teeth, a double Saw, a Sting with two Darts, or vigorous Claws, and a scaly Coat of Mail covers and defends their whole Body. Those whose Nature is the most delicate, are fortified with a thick Skin, which weakens those Frictions and Encounters that might injure them. The Safety of the greatest Part of them, consists in the Agility of their Flight, and, by that means, they evade the Danger that threatens them: Some by the Assistance of their Wings, others by a Thread that supports them, when, from the Leaves on which they live, they suddenly throw themselves at a Distance from their Enemy; and others by the Spring of their hind Feet, whose Elasticity immediately launches them out of the Reach of Insult. In a word, when they are destitute of Force, Stratagem supplies its Place: And the perpetual War we see among Animals, furnishes most of them with their ordinary Subsistence, and at the same time preserves a sufficient Number of the Species, to perpetuate the Individuals.

Without doubt, you are surprized to see Nature so careful in the Equipage and Attire of these Insects we despise; but your Wonder would be different, were you to take a particular Survey of the Organs she has given them

Their Cloathing.

Their Arms offensive and defensive.

Their Organs and Implements.

for their Support, and the Implements each of them work with, according to their different Professions, for every one has its own. Some spin, and have a couple of Distaffs, and Fingers, to form their Thread; others make Nets and Lawn, and for that Purpose are provided with Shuttles and Clews of Thread. There are some who build in Wood, and are therefore supplied with two Bills for cutting their Timber. Others make Wax, and have their Shops furnished with *Rakers*, Ladles and Trowels. Most of them have a Trunk, more wonderful for its various Uses than the Elephant's, and which, to some, serves as an Alembic for the Distillation of a Syrup, Man could never imitate. To others it performs the Office of a Tongue; many employ it as a Drill for piercing, and the Generality of them use it as a Reed for Suction. Several, whose Heads are fortified with a Trunk, a Saw, or a couple of Pincers, carry, in the other Extremity of their Bodies an Auger, which they lengthen and turn at Discretion; and by that means dig commodious Habitations for their Families, in the Heart of Fruits, under the Bark of Trees, in the Substance of Leaves or Gems, and frequently in the hardest Wood itself. There are few who have excellent Eyes, but have likewise the additional Benefit of a couple of Horns or Antennæ, that defend them, and which, as the Animal moves along, especially in the Dark, make a Trial of the Way, and discover, by a quick and delicate Sensation, what would defile, drown or endanger them. If these Horns are moistened in any injurious Liquor, or bend by the Resistance of a solid Body, the Animal is warned of the Danger, and turns another way. Some of these Horns are composed of small Knots, like those on the Heads of Crayfish, others terminate in the Form of a Comb; a third sort are covered with little Plumes, or tufted with Velvet, in order to be preserved from Humidity. Besides these and many other Assistances, which vary according to the Species, most Insects have also the Gift of Flying: Some, as the Dragon Fly, have four large Wings, which correspond with the Length of their Bodies; others, whose Wings are of that exquisite Fineness that the least Friction would tear them, have two strong Scales which they raise and fall like a Pair of Wings, but which are no more than a Case for the real ones. You will find Beetles, *May Birds* and

Spanish

Spanish Flies, furnished with these Cases. You may also observe Numbers who have only two Wings, but under these you will perceive as many Bladders, or hollow Vessels, which are thought by some* to be a Couple of Weights, or a kind of Counterpoise, by the Assistance of which the Insect supports itself against the Agitation of the Air, and continues in an Equilibrium, like a Rope-Dancer who poises himself with a Pole that has a Weight of Lead at each Extremity; though perhaps these hollow Vessels may be judged to be two Castenets, which the Insects strike with their Wings for their Diversion, or else to make themselves known to one another by the buzzing Sound.

Count. I see, Sir, by your attentive Air, that we shall make you a Philosopher.

Chev. As your Lordship does me the Favour to let me continue here for some time, I shall be Master of a Treasure at your Expence. With your Permission, I shall ask you a hundred Questions every Day. I am preparing to make the whole Class of Animals pass in Review before us. I shall be perpetually breaking in upon you, and don't intend to give you a Moment's Rest, till I have robbed you of all your Knowledge.

Count. You may begin your Attack when you please; we shall endeavour to defend ourselves.

Chev. In the first place: I shall beg the Favour of your Lordship, after our Walk, or when it better suits you, to let me see, in a Microscope, these Habits, Arms, and Implements, of which you have told me such Wonders. According to your Description, Insects are as gaily dress'd as ourselves, and their Tools as neatly made as those of our best Mechanicks.

Prior. We may very well compare, as you do, Sir, the Instruments and Habits of Insects with our own; but then it must only be in order to discover the Inaccuracy of our Works, and the Richness, the Elegance and infinite Superiority that shine in those of Nature. Observe the Head of a common Fly in a magnifying Glass.† One can never be satiated with seeing such a Profusion of Gold and

* Derham, Theol. Phys. l. viii.

† Explic. litt. de l'ouvr. de six jours.

Pearls on a Head so inconsiderable, and comparing it with a secret Compassion, with some other Heads that affect the like Ornaments, without being able to imitate them. What has been said of the Lillies of the Field, is applicable to Ichneumon Flies, and a Variety of other Species: *Solomon, in all his Glory, was not arrayed like the meanest among them.* But we must return to what the *Chevalier* has already seen. Do you remember, Sir, what you observed at my House, when you oblig'd me with a Visit? You took my Microscope: What had I fixed in it?

Chev. On one Side you had placed the Sting of a Bee, glewed upon a little Piece of Paper; and on the other a small Needle, so very fine that one could scarce finger it.

Prior. How did the Sting appear to you?

Chev. It was most beautifully polished from End to End, and the Point was not to be discerned.

Prior. Observe one thing however, which I did not mention to you then. At a small Distance from the Point, is an Orifice, through which the Bee launches two little Darts of an inexpressible Fineness, and yet very strong and efficacious; so that what you saw, and is commonly observed to come from the Body of a Bee, is not properly the Sting; but the Sheath, or a kind of Augur, to prepare an Orifice for the two Darts, in order to give them a deeper Penetration. But how did the little Needle appear?

Chev. All blunt and rugged, like a Bar of Iron out of a Smith's Forge.

Prior. The Comparison is just, Sir; and indeed 'tis the same in every thing else: In the Works of Man, you see nothing but Ruggedness, Gaps and Inequalities; the Limits of his Industry, and the Coarseness of the Instruments he employs, are evident thro' the whole; every thing looks as if it had been made with an Axe or a Trowel, and discovers an unskilful Artist, not at all acquainted with the Matter he works upon. On the contrary, the smallest Works of the Creator are perfect. In their interior Parts you will always find a Freedom, a Plainness and a Set of Springs, whose Art, Structure and Correspondence are known by him alone. In their exterior, you will constantly meet with the finest Touches of the Pencil, with Magnificence,
Symmetry

Symmetry and amiable Graces diffused through the whole.

Chev. I am determined to study all the Insects that fall in my way, and mean to be acquainted with the whole Tribe.

Prior. Shew them no Quarter, especially those whose Colours are touched up with Lustre. I pity every Papilio and Ichneumon Fly that shall happen to be near you. However, as the *Chevalier* is so curious about Insects, 'tis easy to give him Satisfaction. Let us entertain him with an Account of the various Changes thro' which they pass, and their different Species: By these Means he will collect those which please him most, range them in better Order, and grow acquainted with his whole Retinue.

Count. With all my heart: Let us begin then with their Birth. Every Insect is generated, like other Animals, from a Seed which contains the Insect in Miniature. This Seed is at first wrapped up in a single or double Covering, which opens when the young Animal has acquired Strength enough to pierce through it. If the little Creature breaks through its Inclosure at the Birth, and comes into the World compleatly formed, and like its Dam, this latter is said to be *Viviparous*. Of this Species are the Palmer, and a Variety of Insects that are to be found on several Plants, and Orange Trees. But when the Female-Parent produces her Young in a hard Inclosure, which is called an Egg, and in which they continue for some Time, she is said to be *Oviparous*.

The Origin
of Insects.
Their first
State.

Among the *Viviparous* Species, the Inclosure where the Seed is lodged, is soft and delicate; because as the Young is always invested with a Cover, while it continues in the Womb of its Mother, it is not requisite that the Seed should have any stronger Defence. In the *Oviparous* Kind, the Covering which infolds the Seed, a little before the teeming of the Dam, becomes a solid Incrustation, to protect the Young from the Weight, and Injuries of the Air, which rolls over the Egg, as upon the Surface of a Vault, without occasioning the least Prejudice to the tender Animal who is lodged in that Inclosure.

All Insects, and Animals in general, are derived, without Exception, from a female Parent, who introduces them

into the World by one of these two Operations of Birth. The *Oviparous* Species always lay Eggs, from whence the Young proceed, after a certain Period of Time, and by the Aid of a particular Degree of Warmth. The *Viviparous* Kinds never fail to produce their Young completely formed: These Laws have subsisted from the Beginning of the World, and were never subject to the least Variation.

Chev. How, my Lord, has an Insect, and even a creeping Worm, had a Mother, like a Lion, who is the Offspring of a Lioness?

Count. The Fact is incontestable. A Lion has had a Mother, who likewise proceeded from a Parent of the same Nature. This also sprung from the like Original, and all those Generations were united in the first Lioness, that God created upon the Face of the Earth. The same may be said of each Species of Insects, whose Generations are equally successive, regular, and invariable.

Chev. How can we reconcile all this, with what is daily presented to our View? Do we not see Insects rise to Life, in a hundred Places where none were to be found before? When a Body has been reduced to a State of Putrefaction, some Species of Insects springs from it, and it is generally said, that they are engender'd from Corruption.

Count. This indeed is the common Opinion; but can you believe my dear *Chevalier*, that when People express themselves in this manner, they understand what they talk about? What is meant by the Corruption of a Body? 'Tis the Dissolution of its Parts. For Instance, Meats and Wine turn to Putrefaction, when the Air, and especially a warm Air, penetrating those Provisions on all Sides, dissipates their finest Parts, and leaves only those that are more gross, and less proper, either to nourish the Body, or regale the Palate. 'Tis not to be conceived, that the inward Parts of a Piece of Meat, after such a Dissipation, Change, and Solution, are, all at once, better disposed to form an organized Body, furnished with Eyes, a Heart, and Intestines; or, in a word, all the constituent Parts of a living Animal.

Chev.

Chev. How, my Lord! do you believe that a Worm, or a Caterpillar, has all you have mentioned?

Count. The least Worm, or the smallest Mite once can possibly discover in Cheese, the minute Eel visible in Vinegar*, and the most diminutive Worm that plays so nimbly in other Liquors, have, each of them, the Parts I have enumerated. 'Tis an Animal that fees, and turns aside when interrupted in its Way; it seeks out its proper Food, eats and digests. It must needs have all that in little which we possess in larger Dimensions.

Prior. I would as soon say, that Rocks and Woods engender Stags and Elephants, as affirm, that a Piece of Cheese generates Mites. Stags are born and live in Woods, and Mites in Cheese; but they both owe their Being to that of other Animals.

Count. Microscopes, and the Anatomy of Insects, have demonstrated this Truth; and their uniform and regular Generation was formerly a Mystery, which at last has been sufficiently cleared up.

Prior. We must convince the Gentleman of this by some new Proofs. The common Opinion that Insects rise from Putrefaction, is injurious to the Creator, and dishonourable to our own Reason. For if we bestow the least Attention on these minute Animals, who are formed with so much Symmetry and Art, and so wisely accommodated with all the Instruments they want, and who perpetuate themselves in a Form that never varies, we must either confess them to be the Production of Almighty Wisdom, or the Offspring of Chance, and the accidental Concourse of some Humours that have been changed and displaced. Now 'tis the last Absurdity to ascribe Agency to Chance; nor is it at all better to say, Chance acts with any Design, Precaution or Uniformity. The same Wisdom, therefore, that appears so admirable in the Structure of a human Body, is as visible in the Composition of an Insect: And Corruption is no more the Parent of these, than it is of other Animals, or even Men themselves. Our next Business therefore is to enquire, whether Insects, wherever they appear, owe their Existence to a new and extraordinary Creation, or whether they are generated from a Seed,

* See the Tables of *Leeuwenhoek*, under the Word *Animalcula*.

with which God, in the Beginning, impregnated every Species, and wherein he has plan'd and deposited the Organs of future Animals, in Miniature; in order to their being disengaged and unfolded by Time. This last Opinion seems most conformable to Reason and Experience, to the Omnipotence of God, and to the sacred Writings; which inform us, that God, in the Beginning commanded every Plant to have Seed in itself, of its own Resemblance, and every Animal to multiply according to its Species.

Chev. I begin to see that Things are as you represent them. We find it difficult, however, to divest our Minds of the Notion, that Insects are engender'd by Corruption: for, as soon as either Wood, or Meat begins to putrify, we see them swarm with Insects. What is it that produces them?

Count. Nothing can be more natural. They are born in such Parcels of Matter, because other Insects have laid their Eggs there.

Chev. But then, my Lord, those Eggs must be universally distributed, and replenish every Place; for otherwise, several things would putrify, without producing Worms.

Prior. The Gentleman is embarrassed, because he sees Worms always appear where there is any Corruption. This inclines him to think, that Eggs are lodged in every Place, and only hatched where they meet with Juices proper to swell and nourish the Seed.

Chev. I have heard the *Count* say, that the little Seeds of Plants are wafted by the Wind, and dispersed all about, and that, at last, they begin to sprout, when they meet with Juices convenient for them. May we not suppose too, that the Eggs of Insects are every where distributed up and down? and that——

Count. Have not I told you we should make you a Philosopher? Your Father and Tutor will find you, at your Return, a perfect Master of Physicks. And I am very glad, Sir, you have struck into such a Train of Reasoning. Several of the Ancients and Moderns have entertained the same Opinion: But don't attribute too much to it. For the Supposition, that the Eggs of Insects are dispersed in the same Manner as the Seeds of Plants, though
it

it may seem so very specious, is not altogether exact. You yourself shall judge.

A Plant that bears Seed, is fixed in the Earth, and cannot transfer them to any other Place; for this Reason, Nature, if I may use the Expression, has given Wings to these Seeds, to prevent their falling all in one Place. Some burst their Shells with great Vigour, and scatter themselves over a large Extent of Land; others are really furnished with little Wings, which convey them by the Assistance of the Wind, to a great Distance; and others, beside this Advantage, have small Hooks, that, in spite of the Wind, fix them to some particular Place. The Design of the Author of Nature could not have a more evident display, and it appears no less in the Disposition of Insects Eggs; but then the Manner is very different; for where-ever you meet with any of these, you will find them fastened by a Glew so tenacious, that 'tis sometimes impossible to disengage them, without entirely breaking them; or else they are shut up in little Cells of different Forms, but all built with Art, and cautiously defended. From whence it appears, that Nature never intended these Eggs should be waisted up and down, but rather that they should be fixed in some certain Place.

Chev. No more of my Comparison: I renounce it entirely.

Count. I have not yet given you a sufficient Idea of the different Situation of the Seeds of Plants, and the Eggs of Insects: The former are entirely abandoned to the Wind; from whence we infer, they ought to be scattered up and down, though they are not to take Root where-ever they fall, but in such Places only, where they meet with Juices proportioned to the Smallness of their Pores. But the Fact is quite otherwise, with respect to the Eggs of Insects: They are unprovided with Wings, to transfer them to different Parts; but then their Parents can fly, and find out convenient Lodgments for them. And therefore if you always see Insects in a Body, as soon as it begins to corrupt, it is not because these Animals are ingendered by Putrefaction, or that the Eggs of Insects are every where scattered and distributed; but 'tis only because they have Mothers, who know that impaired and corrupt Bodies afford the properest Nourishment for their Young:
They

They are attracted by the Odour, which exhales to a great Distance; nay, this very Odour was appointed to act upon them by such an Attraction. And, in general, the Choice of the Parent to lay her Eggs in a Place that abounds with convenient Nourishment for her Young, preferably to any other Situation, is as proper as the original Disposition itself of those Young, to demonstrate, that Corruption cannot ingender any Being, that Chance has no Agency; and lastly, that 'tis only Nature herself who prescribes to every Animal its Place, its Functions, and its Food.

Prior. If Chance does not any way interpose in placing the Eggs of Insects, it has still less to do in forming them.

Count. Nothing happens here by Chance. The Motions of minute Animals seem indeed accidental and capricious, but they as really tend to a certain Point as those of the largest Beings. We shall find all the Sagacity we admire in a Fox, for chusing himself an advantageous Kennel, and the same Industry with which we see a Bird make itself a convenient Nest; I say, we shall find all this actuating a little Fly, in her Choice of a commodious Mansion for her minute Posterity. No Insect abandons her Eggs to Chance, and the Parent is never deceiv'd in the Choice of a proper Situation for them. If therefore the Young find immediate Nourishment when they forsake the Eggs, 'tis because the Mother has precisely chosen the properest Place for their Support. Dissolve a Grain of Pepper in Water, and you will commonly see Worms of an incredible Smallness swimming in the Fluid. The Parent, who knows this to be their proper Nourishment, never lays her Eggs in any other Place. Look at a Drop of Vinegar with a Microscope, there you will discover a Number of little Eels, and never any other Animals; because one particular Creature knows that Vinegar, or the Materials which compound it, is proper for her Family, and therefore deposits them either in that Matter, or the Liquor itself, and no where else. In those Countries where the Silk-Worm feeds at large in the Fields, her Eggs are only to be found on the Mulberry-tree. 'Tis easy to see what Interest determines her to this Choice. You will never find upon a Cabbage, any Eggs of that
Caterpillar

Caterpillar who eats the Willow, nor see upon a Willow the Eggs of any Caterpillar who feeds upon Cabbage. The Moth seeks for Curtains, Woollen Stuffs, dressed Skins, or even Paper, because its Materials are Fragments of Cloth which have lost the bitter Flavour of Hemp, by the working of the Paper-mill. But you will never meet with this Creature, either in a Plant, or Wood, or even in putrified Meat. On the contrary, 'tis in this last, that the Fly deposits her Eggs. What Interest attracts her there? Would not her Eggs be better lodg'd in a fine *China* Vase, which she might always use as she pleased? — Experience will convince you better what it is that regulates her Choice.

Take a Slice of Beef newly killed*, and put it into an open Pot; put likewise another Slice into a Pot that's very clean, and cover it immediately with a Piece of Silk, so that the Air may transpire, and the Flies be prevented from sliding their Eggs into the Vessel. The first Slice will undergo the common Consequence; because the Flies have their full Liberty to lay their Eggs. The other Piece will change and decay by the Admission of the Air; and at last be reduc'd to Powder by Evaporation; but neither Eggs, Worms, nor Flies will be found there: The most that can happen will be this, the Flies allured by the exhaling Odour, will settle in Swarms upon the Cover, and endeavour to enter; but at last will leave their Eggs upon the Silk, being unable to penetrate any farther.

Prior. This Instance makes it evident, that Corruption cannot ingender any Animal, and indeed, several Insects seek what is quite different from it, to lodge and nourish their Young. But if some Animals live in Putrefaction, 'tis no more surprizing to see them lay their Eggs in a Body tending to Corruption, than it is to view the Mother of a Family, and her Children, working with Sickles in a Field of ripe Corn. All Nature is full of Animals, some fixed to one kind of Nourishment, others to a different. All of them have their Eyes attentive on their Prey, and nothing eludes their Penetration.

Chen. I now begin to see more Order and Design in

* See the Experiments of *Redi*, *Arezzo* and *Leuwenhoek's* *Anat. & Contempl. Arcan. Nat.* Tom. I.

the Conduct of the least Animals, than I before imagin'd.

Prior. The more you come to particulars, as amazing as the Variety of Species, and their different Manner of subsisting may appear, you will, thro' the whole, see repeated Traces of the same Wisdom which inspires each Parent with a tender Solitude for her Posterity, and works, if I may so express myself, by the same Plan, in referring every Species to the same Original; I mean a Generation by Eggs, or the Seed lodged in them.

Count. Let us now see what an Egg
The Egg. contains. When the Female who produces it, has not had any Commerce with the Male, it is only replenished with a barren Nourishment, that soon dries and evaporates. 'Tis the Male that gives the Egg its Fecundity; and then, besides the fine Aliment the Shell incloses, there is lodged in it a minute Animal, which no Hand, but that of the Deity could form, with a Resemblance to its Female Parent. This little Creature, protected by the Shell that surrounds it, in consequence of a Law that surpasses all our Knowledge, is gently nourished by the Fluid in which it swims. It increases in Bulk, and at length, perceiving its Habitation too contracted, breaks its Inclosure, and immediately finds itself accommodated, by the Wise Precaution of its Mother, with a Food more strong and suitable to its new Condition.

Some when they leave the Egg, have
Their second State. their perfect Form, which they never lose as long as they live. Of this Kind are Snails, who quit the Egg with their House on their Back. They always preserve the same Shape and Habitation, only when they grow larger, some new Circles are added to their Shells. Under the same Class we may rank Spiders*, who are perfectly formed when they come out of the Egg, and only change their Skin and Bulk. But the Generality of other Insects pass through many Varieties of Being, and assume the Form of two or three Animals successively, who have no Resemblance to one another.

Chev. How, my Lord! Will a Caterpillar ever be any

* *Leuwenboeck's Arcan. Nat. Tom. iii. Epist 138.*

thing but a Caterpillar? And has a Bee ever been any Animal different from a Bee.

Count. Without doubt. There is an infinite Number of these little Animals who are composed of two or three Bodies very differently organized, the second of which unfolds itself after the first, and the third receives its Birth from the second. These are so many Metamorphosis. Have you never seen those of *Ovid*, Sir?

Chev. I am now reading them, and have gone through half of that Work. Those agreeable Fables divert me exceedingly; but, after all, they are but Fables, unless they contain some hidden Meaning; and that is what I wish somebody would discover to me.

Count. You are in the right, and should give no Quarter to those who let you into their Explanation. In reading them, you must endeavour to unravel those ancient Histories that lye disguised under some of these Fictions, as well as those equivocal Expressions of the ancient Languages, that have given Birth to others. But since I find you as much a Friend to Truth as you are to the Marvellous, I shall charge myself with the Care of all your Pleasures, and intend to bring you acquainted with a System of Metamorphosis infinitely more surprizing than those of your *Ovid*, and of whose Reality, your Sight and Touch shall fully convince you.

Chev. That's the very thing I desire.

Count. What would be your Surprize, should I tell you, there is a certain Country where a Multitude of Animals in different Forms, are to be met with, some of whom live deep in the Earth itself, others in the Water, and who afterwards assume a new Figure, live upon the Surface of the Ground, and creep like Serpents through Woods and Fields; and after a certain Period, cease to eat, and build themselves Habitations, or rather, Monuments of Death, where they continue buried several Weeks, and sometimes Months, and whole Years, without Motion or Action, and to all Appearance, without Life itself; and who, after all this, revive, in the Form of Birds, and break through the Inclosure of their Sepulchres, unfold a most beautiful Plumage to the Sun Beams; and with expanded Wings commence Inhabitants of the Air?

Chev.

Chev. I should be glad to know where this Country lyes, and what are the Names of those Birds. But I find it very difficult to believe, that ———

Count. Nothing in Nature is more certain. The Country I am speaking of is our own, and these Animals are the Insects who are daily presenting themselves to our View.

Chev. How! are we we talking of Flies and Caterpillars; Wasps and Bees.

Count. The very same.

Chev. What Change do they undergo.

Count. These and many other Insects, when they come out of the Egg, are no more than little Worms, some without, and others with Feet. Those who have none, are left to the Care of their Parents, who take upon them the Charge of lodging their Offspring in commodious Habitations, and furnishing them with their necessary Aliment, or they even place them in the Center of the Substance that is to sustain them. Those who have Feet, look out for Nourishment themselves, on the Leaves of a Tree, most suitable to them, and which proves to be the very same on which their Mothers have placed them. In a little Time they increase very sensibly in Bulk. Many of them cast off their Attire, and assume a new Youth, in a Skin they change five or six Times. After this, all of them (remember I am speaking of those who undergo any Change) pass through an intermediate State, called either the *Nymph*, or *Crysalis*. These are different Terms, that signify very near the same Thing, and of which 'tis necessary to give you the Explanation. The little Worm, in Process of Time, ceases to feed; and incloses itself in a Kind of small Sepulchre, that varies according to the Nature of the Animal, but is built by each Species in an uniform Manner. And there, under a Foldage that preserves the extreme Delicacy of its Texture from all Injury, it acquires a new Conception, and a second Birth. 'Tis then called a *Nymph*, which signifies a young Bride, because the Insect in that Period puts on its beautiful Attire, and assumes the last Form, in which it is to multiply its Species by Generation. This Form is called the *Chrysalis*, or the *Aurelia*, or Golden Nymph, because

because the little Film, whether hard or tender, with which it is invested, is by Degrees tinged with a very bright and glowing Colour. It likewise goes by the Name of the *Cone*, *Shell*, or *Bean*, because 'tis then wrapp'd up in a Skin generally very hard, and like the Shell of an Egg, or the Coat of a Bean. But it must be granted, that the Term *Cone*, is most commonly used to signify those little Balls of Thread and Glew, in which Silk-Worms, and some Caterpillars wrap themselves when they become Nymphs.

In a Word: Their fourth and last State, Their last
the great and final Metamorphosis which State.
happens to them, is when they rise out of their Tombs, and become flying Insects; they then break thro' the Inclosure that surrounds them, and the Plumes which adorn their Heads begin to appear; they unfold their Wings, and — But let us defer the Wonders of their Resurrection till to morrow. We must allow our good Friend the Chevalier, a little Time for Hunting.

Cher. No my Lord: Let me intreat you to proceed. Some of these *Aurelias*, in which Caterpillars intomb themselves, have been often shewn me in the Form of Infants in Swadling Cloaths; but I thought they had been dead, and no body undeceiv'd me. You will give me a singular Pleasure in acquainting me how this Change is accomplished.

Count. To-morrow we will enter upon the Particulars. In the mean Time, I am not a little pleased to find you relish our Metamorphoses; but I would willingly give them a new Merit.

Cher. What may that be, my Lord?

Count. To make them desirable. But let us reserve them for another Conversation. I know you are uneasy at this Delay, and believe me, Sir, I am charmed at your Impatience. There are very few of your Age, who would not be pleased at the Conclusion of such a Conference as this.

The End of the first DIALOGUE.

CATER-

CATERPILLARS.

DIALOGUE II.

The COUNT, and COUNTESS,
The PRIOR, and
The CHEVALIER.

Count. I Don't see any Body here. My Lady's Company is all withdrawn. Let us place ourselves in this Arbour, and continue our History of Insects.

Prior. The *Chevalier* has been reading to me this Morning, a Summary of our Yesterday's Conversation, which will please your Lordship exceedingly. He fully demonstrates, that Corruption would be possess'd both of Wisdom and Power, were it capable of forming an organized Body; he succeeds as well in the Reasons he assigns for the Parents Choice of those different Places where we find their Eggs; and has been as accurate in his Account of the various Changes the Generality of Insects undergo.

Count. We must appoint the *Chevalier* our Secretary, I am persuaded I shall find my Advantage in it; for whenever my Affairs oblige me to be absent, I shall know, by his Means, all the Particulars of your Conferences.

Prior. Believe me, *Chevalier*, since you have already acquired a Habit of Thinking, and can express the Thoughts of others with such a Grace and Perspicuity, you have gained a noble Point, and we intend to make you the *Fontenelle* of our Academy.

Count.

Count. Where did we break off Yesterday?

Chev. We were upon Insects who change their Form to that of a Nymph, from whence your Lordship, by a new kind of a Resurrection, or Metamorphosis, converted them into another Set of living Animals. And now I should be glad to know if they really die before this Transformation.

Count. May we not venture to shorten the Expression and affirm, that the Insect actually dies, after its Conversion into a Nymph? 'Tis a real Animal, furnished with Eyes and Feet, a Body and Intestines; in a word, with all the Members proper for it; and which are entirely different from the flying Animal who is to succeed it. It divests itself of its Head, its Eyes and Body, and is then in an evident State of Death. Take away the Head and Body from any other Animal, and you deprive it of every Thing essential to Life. The Destruction of the Parts, implies that of the Whole. Thus the Lion, the Horse, and all other Creatures, cease to live. But as for the Worm, the Caterpillar, and a Variety of other little Animals who are thought so despicable, their Death is the Original of a new Existence; their End is the Commencement of another Order of Things. When a Worm is dead it produces a Fly; a Butterfly rises from a Caterpillar; and Insects that fly, proceed from those that creep*.

'Tis true, the former Animal furnishes an Inclosure to a living Embrio that resides in it, and compleats its Form, after the Destruction of the preceding Insect. 'Tis also granted, that 'tis possible to discern the last Animal under the Skin of its Predecessor, in which it lay involved. But still the first is a real Animal, who dies to make room for the second.

Prior. We must observe however, that the first Animal is no Stranger to the second, but regards it as Part of itself, or rather, a second Self, wherein it shall enjoy a Renovation. The indefatigable Care with which it builds a Repository for the Spoils of the old Insect, sufficiently intimates its Expectation of something better, and more exalted. 'Tis not at all intimidated with this Appearance of Death, which is no more than its Passage to a more amiable State;

* History of Insects, by Swamm.

and, far from being dismayed at the View of its Winding Sheet, it exists with Affiduity and Joy, in preparing it, exhausts all its Strength and Substance to compleat it; and it may be said to die like a Grain of Corn, whose constituent Parts are dissipated under the Earth, in order to be nutritimental to the Bud that will spring from those Remains.

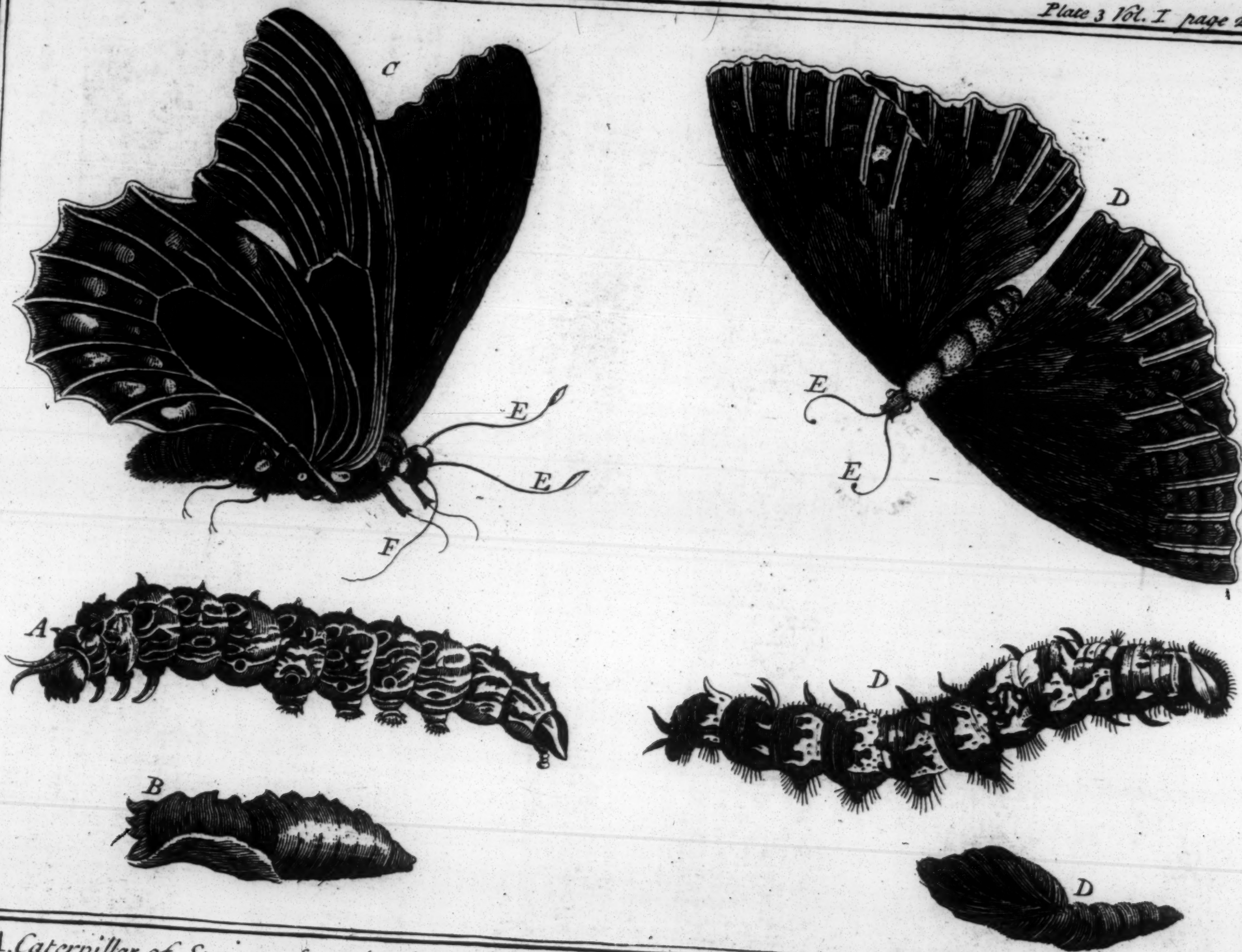
Count. Let us quit all general Propositions, and descend to Particulars. There are some Insects, whose only Food is the Herbage of Fields and Gardens. Others feed upon the Wood, into which they eat their Way. Some find a Subsistence even in Stones. Another Class can only live in Water, or other Liquors. And several Tribes feed upon the Substance of other Animals. As the Subject is therefore so extensive, let us select those Species which are most familiar to us. The *Chevalier* is already acquainted with Silk Worms and Caterpillars, and we will begin with them.

Chev. I have been long desirous of having a right Idea of the Matter they spin, and the particular Form of the Distaff they employ on that Occasion: But I see the Countess behind the Arbour; let us advance and receive her.

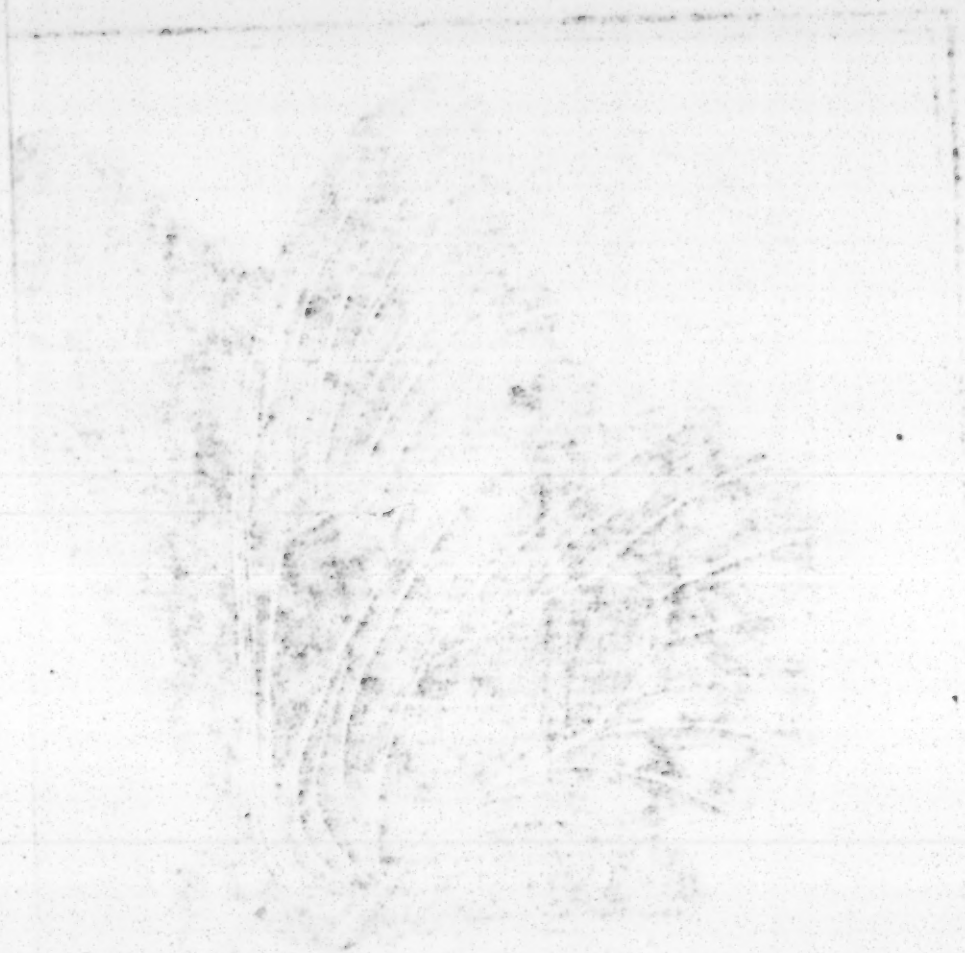
Countess. Gentlemen, since your Conversation turns on Distaffs and Thread, I have some Privilege to be seated among you; and I shall now be glad to know the Subject you chuse for your Entertainment.

Count. We were talking of Silk Worms and other Caterpillars whose different Species already known, amount to more than three hundred†; and every Day new ones are discovered. One Species entirely varies from another in Shape, Colour, Inclinations and Manner of Life: But in the same Species every thing is perfectly uniform. Let us first examine what they all have in common. They are all composed of several Rings like Silk Worms; and as they enlarge and Rings. contract the Distance between them, they move their Bodies wherever they have occasion to transfer them. They have a certain Number of Feet which bend and play, by the Means Feet. of little Joints; and are armed with Claws,

* See *Godart's* general History of Insects. *Aubriet's* Collection.



A. A. Caterpillar of Surinam. See the figure 17 of the Collection of Madam Maria Sibylla Marian. B. The Chrysalis of this Caterpillar. C. the Butterfly Sprung from the Chrysalis. D. Another Animal of the same Collection. E. the Antennæ or Horns. F. the Trunk for Suction.



to fix and rivet themselves to the Bark of Trees, especially while they sleep. The Generality of them have a Thread, whose Substance is a liquid Gum; which they extract from the Leaves they eat. When they are apprehensive of being carried away by any Bird, or crushed by the moving Branches, they shed a few Drops of this Gum upon the Tree; and then, precipitating themselves, spin it in their Descent through several Orifices of their Bodies, that furnish as many different Threads, which they bring together with their Claws; and as the Threads are moistened with a natural Glew, that unites them by a strong Cohesion, they, by these Means, form one entire Thread, capable of sustaining the Animal's Body in the Air †.

Countess. Methinks I see one of our Ropemakers, who, after he has fastened the End of his Work to the Wheel, retires from it backwards; and continually throws out several Twists of Hemp, which he mixes together, and joins with his Fingers; and out of them all makes but one Rope.

Prior. The Comparison is very just; and the only little Difference I can observe in it, is, that the circular Motion, which is perpetually communicated by the Wheel, to all the Rope, is that which joins several Threads into one, under the Fingers of the Workman; whereas, in the Instance before us, 'tis a certain Glew which unites the several Threads, by the Aid of the Caterpillar's Claws.

Count. What surprizes me most, is, that a Fluid which seems, when the Caterpillar is crushed, to be very limpid, should thicken into a Consistence, and grow dry and tenacious, the Moment the Creature goes to work with it; in short, that it should immediately be useful to her as a strong Chain, to keep her suspended out of the Reach of Danger, and should afterwards assist her, like a Ladder, to ascend to her former Situation.

This is not the only Assistance Nature has granted to her extreme Imbecility; for she is generally covered with Hair, which preserves her from the rude Access of Waters, in which she would otherwise be drowned or frozen. The same

Hair.

† *Leuwenboeck*, Arcan. Nat. Tom. iii.

Hair warns her to slide down from her Station, before the Branches, agitated by the Wind, can crush her; and when the Thread, by which she hangs, is disconcerted or broken, the Hair, with which she is thick set, prevents her from being bruised in her Fall.

Colours. Would you believe, *Chevalier*, that even the Colour of Caterpillars is one of the best Preservatives many of them enjoy, against the Birds, who can find no Sustenance so delicate and proper for their Young, as these Creatures*?

Chev. Does your Lordship mean those little shining Specks with which their Backs are spangled?

Count. No: These Specks rather contribute to distinguish them, especially when they are seen near. What I mean, is, that almost all of them have one principal Colour, which perfectly resembles that of the Leaves they feed on, or the little Branches where they fix themselves, when they cast their Skins. The Caterpillars who eat Buckthorn are altogether as green as that Plant. Those who are nourished with Elder, assume the Complexion of that Tree. You may observe on Dwarf and Apple Trees, Numbers of these Creatures, that are as much embrowned as the Wood of those Plants. They are very careful to quit the Leaves and prudently retire along the Branches, when the time for casting their Skins is come. By these Means they are confounded with the Matter that supports them, are rendered less visible, and during their long Sleep, escape the Birds who are searching for them.

Chev. But to what Purpose then has Nature furnished Birds with a Bill to seize their Prey, if that Prey has a hundred Conveniencies for escaping?

Countess. Does not the *Prior*, find a Contradiction in this?

Prior. I confess, Madam, a seeming Contradiction appears, and indeed reigns through all Nature; but in Reality, 'tis the Effect of a Sagacity which is no less evident. This pretended Contradiction keeps all Nature in Exercise and Action. All the mute Creatures are either employed in Invasions or Defence, and Nature has given Arms offensive and defensive, to each Individual. By these Means

* *Derbam*, Theol. Phys. l. 4. c. 14.

hey all find Animals enough to sustain one another, and yet there is a sufficient Number preserved to perpetuate the Species. Each Family is sustained, and every Table furnished to this Moment, and yet there is a large Overplus of Provisions for many Days. Is there not a kind of Contradiction, in permitting Fishermen to catch Fish, and, at the same time, obliging them to use Nets with large Meshes, thro' which not only the Fry, but even Fish of a considerable Size escape? And yet this is no more than a just Precaution taken by a wise Government, which at once provides for present Necessity and future Want. Nature has accommodated all Animals with Nets, and permitted them to fish and sustain themselves; but then she has prudently limited the Dimensions of the Meshes. Vast Quantities of Fish are daily caught, but there are always more preserved than taken, whether they escape through the Meshes, or else happen not to be invaded.

Countess. Chevalier, we are not the best Managers of a Contradiction: When you start a Hare, and she employs all her Subtlety to escape your Dogs, do you find any Contradiction there?

Chev. None at all. On the contrary, nothing is more natural or better designed. If Hares did not defend themselves, our Dogs would have no Employment.

Count. What you observe in the Hare and Dog, you may pronounce of other Animals, and even Insects themselves. Nature, by enabling some to attack and seize, has not left the others defenceless: The least have their Preservatives. You see, that even such feeble Insects as Caterpillars, are not unprovided with the Means of their Security, and to these they add their little Policies and wise Precautions. For Instance; you will oftner find them under, than upon the Leaves they eat; the Reason is, that they may not be discovered by the Birds. Oftentimes they do that before a Bird, which a Mouse practises in the Sight of a Cat; they counterfeit Death, to amuse their Enemy. And when, by this Stratagem, they have made him negligent, they improve the favourable Moment, and conceal themselves.

Prior. I have seen * others extended in a motionless Posture, and counterfeiting Sleep; upon which a Number

* Godart.

of little winged Vermin, that were flying about at a small Distance, have immediately fasten'd upon them, as a sure Prey. The Caterpillars, for some time, let them run over their Backs, and then suddenly turning their Heads, seized their Enemies, and regaled themselves with their Flesh.

Chev. How, Sir, are they Flesh-Eaters too?

Count. This Species, which the Prior mentions, instead of being a Caterpillar, is rather a carnivorous Worm, that feeds on these Vermin. All Insects have a Method, and a Food peculiar to them, and from which they never vary. Caterpillars, for Instance, are not only limited to Herbage, but likewise to a particular Species of it; each Class of these Creatures has been enjoined to content itself with one particular Plant, and they are so strict in their Obedience to this Command, that they will sooner perish with Hunger than touch any other Plant; unless they meet with one whose Qualities correspond with their ordinary Food. However, we must except from this Rule, some particular Species, who are less precise in this Point, and can accommodate themselves to any thing.

Chev. Is there not some Inconvenience, my Lord, in this Regulation? Suppose a Plant, assigned to one certain Species of Caterpillars, should happen to fail, that Class of Insects would be extinct too. Why should they be confined then to such narrow Bounds?

Countess. You criticise upon Nature, Sir, where you certainly ought to thank her. If our Apple Trees, that at present have only a few Species of Caterpillars for their Enemies, were given up to the Ravages of two or three hundred, judge how our Deserts would suffer? It was therefore wisely ordained, that Caterpillars should only be destructive within certain Bounds.

Chev. I am sensible that I had no Reason for my Complaint, since we find our Advantage in this Limitation. I should rather have asked, why some Species often multiply to such a Degree, as to carry Destruction with them wherever they go? It is not many Years since that Species which love the Apple-Tree, did not spare so much as one Leaf. Those Trees were all loaden with Fruit, which immediately

diately withered away, and perished." What therefore may the Use of Caterpillars be in general? In my Opinion we might do very well without them.

Prior. They are very far from being useless: Destroy Caterpillars and Worms, and you starve the Birds, for those we eat, as well as those who entertain us with their Songs, have no other Sustainance in their Infancy. 'Tis then they address their Psalm cxlvi. 9. Cries to the great Creator, and he multiplies Food for them, accommodated to the exceeding Delicacy of their Texture. In a Word, 'tis for them that he every where disperses Worms and Caterpillars.

Count. The little Birds in Reality, don't forsake their Eggs, till the Fields are replenished with Caterpillars; and these disappear, when the Young, grown stronger, have Occasion for another Sort of Nourishment, or can live without the Food they were first accustomed to. Before the Month of *April* there are no Caterpillars, nor Broods of Birds. In the Month of *August*, or *September*, there are neither Broods nor Caterpillars; the Earth is then covered with Grain, and other Provisions of every Kind.

Prior. Till that Time the Birds have Caterpillars assigned them for their Support, and 'tis but just that these should likewise be furnished with proper Food, and this they are supplied with from the Plants. They have a Right as well as ourselves, to the Verdure of the Earth: They have a certain Title, founded in the Permission God originally gave to every Creature who lives and creeps upon the Earth, of receiving its Nourishment from the Plants; and their Charter is as authentick as ours, since it is precisely the very same.

The Participation of the Herbs and Fruits of the Earth, which Insects are permitted to enjoy in common with Man, is sometimes very prejudicial to him; and, as such, was both foreseen and ordained. Man wants to be instructed, as well as sustained. His Ingratitude is confounded, when these Insects deprive him of what God had display'd to his View with so much Liberality; and his Pride is no less humbled, when the Lord commands

his avenging Armies to march forth, and, instead of Lions and Tygers, or other formidable Animals, sets Caterpillars, Flies, and Locusts, in array against him. Such inconsiderable Instruments as Worms and Flies, are employed by the Almighty, to humble the Pride of Men, who are too apt to flatter themselves, that they are rich, and great, and independent. You see, my dear *Chevalier*, that the same Hand which created the Fly and the Caterpillar, has also formed the Lion and the Tyger. He has prepared a convenient Nourishment for them all, be-

cause he knows the particular Uses for
Ecclef. iii. 2. which he has reserved them. *Every thing he has made is good in its Season;* and when

our weak Apprehensions cannot penetrate into the Motives of his Works, should we, for that Reason, presume to diminish from them, or wish any Addition to them? But you will tell me I am preaching, and therefore we will return to our History of Caterpillars, and beg the Favour of the *Count*, to give us a View of these Creatures, as they are employ'd in building their Tombs.

Countess. I find you don't expect much from me, and so I am not asked any Questions. However, I would willingly be of some Consequence in my Turn; and desire Leave to send my Servant up to my Closet for a little Box, that will speak for me, as well as a fine Oration.

You will find in it what will entertain your
 Their Tombs. Eyes at least; in the mean Time, let us take a View of the Caterpillars Funeral.

Count. Towards the End of Summer, and sometimes sooner, these Insects, when they are satiated with Verdure, and have changed their Skin several Times, cease to eat, and employ themselves in building a Retreat, wherein they are to quit the Life and Form of a Caterpillar, to give Birth to the Butterfly they contain within them. A few Days are sufficient to conduct some into a new State of Existence. Others continue whole Months and Years in their Sepulchres. There are some Species that plunge themselves to a small Depth in the Earth, after they are satiated with their Food. In that Situation they begin their Efforts, and rend their Robe, which, with the Head, the Paws, and Entrails, shrink back like a Skin of dry Parchment; and there remains a Substance
 that

that resembles a Bean, or a Kind of Covering of a brown Complexion, with an oval Form, the most pointed Part of which terminates in several moving Rings, whose Dimensions are gradually diminish'd. This is the Chrysalis, that incloses the Embryo of the Butterfly, with such Fluids as are proper to nourish, and compleat its Growth. When the Creature has acquired its perfect Form, and is invited by a genial Warmth, to quit the Scene of its Confinement, it bursts the large Extremity of its Inclosure, which always corresponds with its Head, and is weak enough to be opened at the first Effort.

Some Caterpillars, instead of sinking themselves into the Earth, prepare a Lodgment under the Projections of Roofs, in the Cavities of Walls; under the Bark of Trees, and even in the Heart of the Wood. All of them have sufficient Abilities to secure themselves a safe Retreat, for the Time they are to continue in the Form of Aurelias.

There are others who suspend themselves, with great Dexterity, to the Roofs of Houses, or the first Stake that occurs in their Way, and they proceed in the following Manner. The Caterpillar extracts from her own Substance a glutinous Fluid, which lengthens, and acquires a due Consistency, in proportion as she advances her Head from one Place to another: And when she has glewed and interlaced several Threads on some smooth Place, to which she intends to fix herself, she insinuates her hinder Paws into a Complication of the Tissue, by Means of the minute Claws in which they terminate. In this Manner she accomplishes her first Fastening; after which she rears her Head, and fixes a new Thread on the lateral Wood that corresponds with her fifth Ring, and then with a gentle Deflection of her Head, she draws this Thread, in the Form of a Bow, around her Back, and then fastens it to the opposite Side. She frequently repeats these Motions, in order to conduct the Thread from the Left to the Right, and from the Right to the Left. When this second Band, which sustains the Animal above the Middle of her Body, has been sufficiently doubled and fortified, she rests upon it, and then agitates her Body, till it is intirely covered with Sweat. She then bursts her Skin, which gradually shrinks to the Side where her Paws are implicated in the Wood. Those Paws are likewise

dissipated like the rest of her Spoils ; but all this is not sufficient to disengage the Chrysalis, because, instead of the Paws, by which it was detained, the Extremity of the Bean has shot out a Set of little Points, whose Heads terminate like that of a Mushroom, or Nail ; and as they are extended beyond the Threads, they are sufficient, with the Band that traverses the Back, to fasten the Bean, till the proper Season, when the Papilio is to be discharged from her Confinement.

I have been told that some Caterpillars involve their Bodies in a Texture of Thread and Glew, and then roll themselves over a Bed of Sand, by which Means they collect an Incrustation of small Grains, and build themselves in this Manner, a Monument of Stone. I have seen this Operation performed by other Insects.

There are others who build in Wood, and crumble into small Particles the Substance of a Willow, or some other Plant to which they have habituated themselves. They afterwards pulverize the whole, and form it, with an intermixture of Glew, into a Paste, in which they wrap themselves up. This Composition dries over the Chrysalis it surrounds, and which assumes much the same Figure ; so that it resembles a Mummy, which corresponds with the Form of the Body it incloses, and to which it serves as a Defence. I have some Insects, in this Form of the Chrysalis, about me, and fancy the *Chevalier* will be pleased with the Sight.

Chev. They are really very entertaining Figures, and one would be apt to take them for Pagods, or Infants in Swadling Cloaths. Is it possible there should be any Life within ; and is a Butterfly to spring out of the Ruin ? The whole Mass seems to be quite dead.

Count. If you press them a little, you will find some Signs of Life. I could not give you a better Idea of their State of *Aurelias*, or *Nymphs*, than by letting you see these little Tombs, out of which as many Butterflies are to rise. Those who are Females will lay their Eggs, either upon the very Plant that formerly nourished them, or upon one of the same Sort. They range their Eggs sometimes in a strait, or else in a circular Situation : Sometimes they wind them in a spiral Line, round a small Branch, and always fasten them with such a binding Glew,

Glew, that the Heaviest Rains can't wash them away.

You will find some Caterpillars, who, in their Works, neither imitate the Mason nor Carpenter; but artificially spin themselves a warm Robe to secure themselves from the Rain. We shall give you a clearer Conception of this curious Work, when we come to describe the Cones of Silk-Worms; to which they bear a perfect Resemblance.

The Caterpillars we are most acquainted with are found in great Numbers upon Elms, Apple-Trees, and Bushes. The Papilio that proceeds from these, chuses some beautiful Leaf, on which she fixes her Eggs in Autumn, and soon after dies, glewed and extended upon her beloved Family. The Sun, whose Rays have still some Power, warms her Eggs, out of which, before the Winter Season, a Multitude of little Caterpillars spring, who without having ever seen their Mother, and without the least Model or Instructions, immediately, with a Kind of Emulation, betake themselves to Spinning, and with their Threads industriously weave themselves Beds, and a spacious Habitation; where they shelter themselves from the Severity of the Season, distributed into different Apartments, without eating, and frequently without stirring abroad. There is only one little opening at the Bottom of this Mansion, through which the Family sometimes take the Air towards Noon, in a fine Sun-shine, and sometimes in the Night, when the Weather is settled. When you would open their Retreat, you must employ a little Strength to break the Tissue that forms it, which is generally as firm as Parchment, and not to be penetrated by Rain, Wind, or Cold. There you find the whole Family reposing on a soft and thick Down, and surrounded with several Folds of the Web they have spun, which at once supplies them with their Quilts, their Curtains, and their Tent.

Cher. 'Tis extremely surprizing to see such tender Animals pass the Winter in this Manner; but it amazes me yet more, that they should live all that Season without eating.

Count. There are various Species of Birds, Reptiles and Insects, who sleep several Months in this Manner; and as they suffer no Dissipation of their Animal Spirits, so they want no Recruits of Food.

Countess. There is an odd Peculiarity among Caterpillars,

An Objection
against the re-
gular Generati-
on of Caterpil-
lars.

lars, and I am very desirous of having it cleared up. In order to make a fine Collection of Papilio's, I have frequently procured, and nourished the Caterpillars that produce them; but instead of obtaining a Birth of Papilio's from them, they have frequently disappointed me with a Race of Flies.

Prior. This I have often observed, myself. One shall see, for Instance, a swarm of little Flies marching out of a living Caterpillar, thro' the Apertures they have pierced in her Skin. We sometimes observe * several Worms proceeding from that Animal; after which they enfold themselves in a Covering of Thread, and seem in a short Time to be changed into Flies. I have even seen Flies extremely small, issue from the Eggs of Papilio's.

Cher. If one Species is thus changed into another, the Generation of Insects can never be regular and uniform.

Count. These Flies are not the Offspring of the Caterpillar, who never engender'd any Animal whatever; and it is impossible they should be the Progeny of the Papilio, who can produce nothing but the Eggs of Papilio's. The Microscope has enabled me to unravel this Mystery, and I have discovered, by its Assistance, two Apertures in the Eggs of those Papilio's, from whom the little Flies spring: One of them is very large, and it affords the Fly a Passage out of the Egg: The other is extremely small, and the Fly passed into the Eggs through this, in the Form of a Worm, which proceeds from the Egg of a Fly. This Worm penetrates the Egg of the Papilio, in order to settle there; and when this is accomplished, it throws away the spoils of a Worm; and then the little Chrysalis, which lay involved in those Spoils, produces the small Fly that issues from the Egg.

There are several Species of Flies who fasten on the Body of a Caterpillar, and deposit their Eggs in the Punctures they have made in that Animal; in Consequence of which, those Eggs are productive of Worms, Aurelias, and Flies. A Variety of Mistakes, with Relation to the Origin of Insects, have been occasioned, for want of knowing the Method Flies take, to deposit their Eggs in such

Places as can best afford a convenient Food for the Young that are afterwards to proceed from them.

Prior. I lately saw a large Fly pierce the Skin of one of those Caterpillars * that feeds on the Leaves of Elms; and from that Puncture proceeded one of those Flies that gave Battle to the Garden Spider. I wish we had the two Champions here, to entertain the *Chevalier* with their Combat. The Fly, at the first Encounter, darts with all its Force upon its Enemy, who lies in Ambush in the Center of the Web. The Spider immediately falls from its Situation, stunn'd with the Shock; but in his Descent, always spins his Way down. The Fly takes Advantage of his Adversary's Disorder, springs from his Body, and after he has dragged him to the Earth, breaks all his Legs; he then wheels very fiercely round the Spider, either to seize him in some Part where he can have no Apprehension of his Claws, or else to testify his Joy at his Victory over the Enemy of his Species: And after he has thus marched round him, two or three Times, he fastens upon him, and immediately mounts into the Air with his Captive.

Chev. This Creature is the very *Achilles* of the Flies, and that Hero treated the unfortunate *Hector* exactly in this Manner; for, after he had overthrown him in the Dust, he disarmed him, and, when he had offered him a thousand Insults, dragged him to his Tent.

Count. If you have any Inclination to be acquainted with the other Tribes of these Creatures, their Inclinations, and various Properties, you may, while you continue in the Country, make a Collection of all their Species in little Boxes; but you must remember to supply them every Day with green Provisions, suitable to their several Natures; and, when you have done this, you cannot imagine what an agreeable Amusement you will receive from the Variety and Exactness of their Operations.

Countess. For my Part, I think the *Chevalier* is already very attentive to the Cones, that are nearest their Change, and seems to wait with Impatience for the Resurrection that is to ensue.

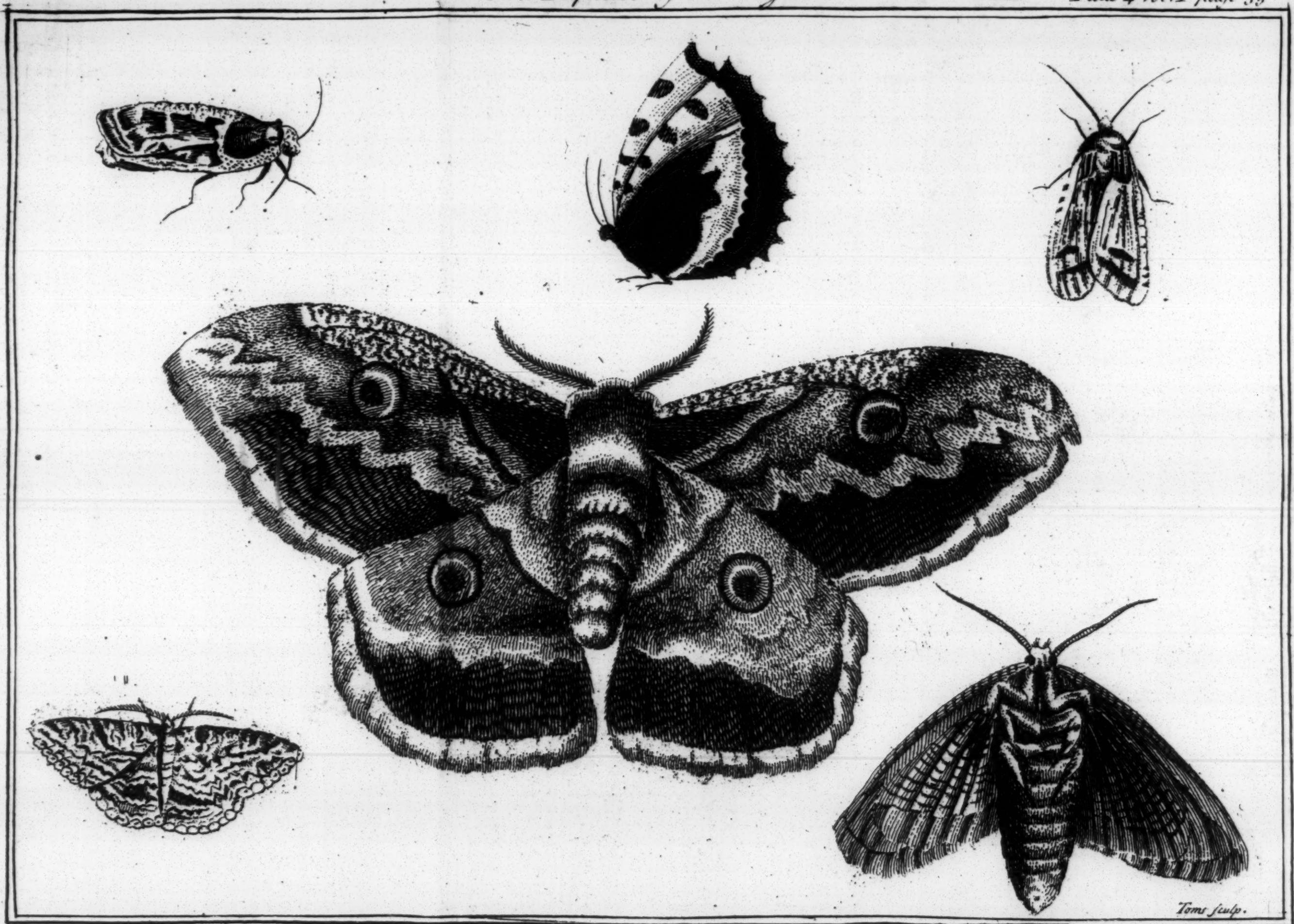
* Godart, *Exper.* liii.

Prior. How is it possible to be unaffected with this little Miracle of Nature! Open one of these Aurelia's, and it will seem to present you with nothing but a Kind of Putrefaction, in which every thing is confounded; but then, this Putrefaction contains the Elements of a better State of Existence, and composes the nutrimental Juices which contribute to the Growth of a more perfect Animal. The Time for its Enlargement, at last arrives, and the Creature then forces its Way through the Prison that contained it. The Head disengages itself through the Aperture, the Horns lengthen, the Legs and Wings are extended, and at last, the Butterfly takes its Flight through the Air, and retains no Similitude of its former Condition. The Caterpillar, who is changed into a Nymph, and the Butterfly that proceeds from it, are two Animals entirely different. The first was altogether terrestrial, and crawled heavily along the Ground. The second is Agility itself, and is so far from limiting its Motions to the Earth, that it, in some measure, disdains to repose on its Lap. The first was all shaggy, and frequently of an hideous Aspect. The other is array'd in Colours of the most beautiful Glow. The former stupidly confines itself to a gross Food; whereas this ranges from Flower to Flower, regales itself with Honey and Dews, and perpetually varies its Pleasure. This new Animal enjoys all Nature in full Liberty, and is itself one of her amiable Embellishments.

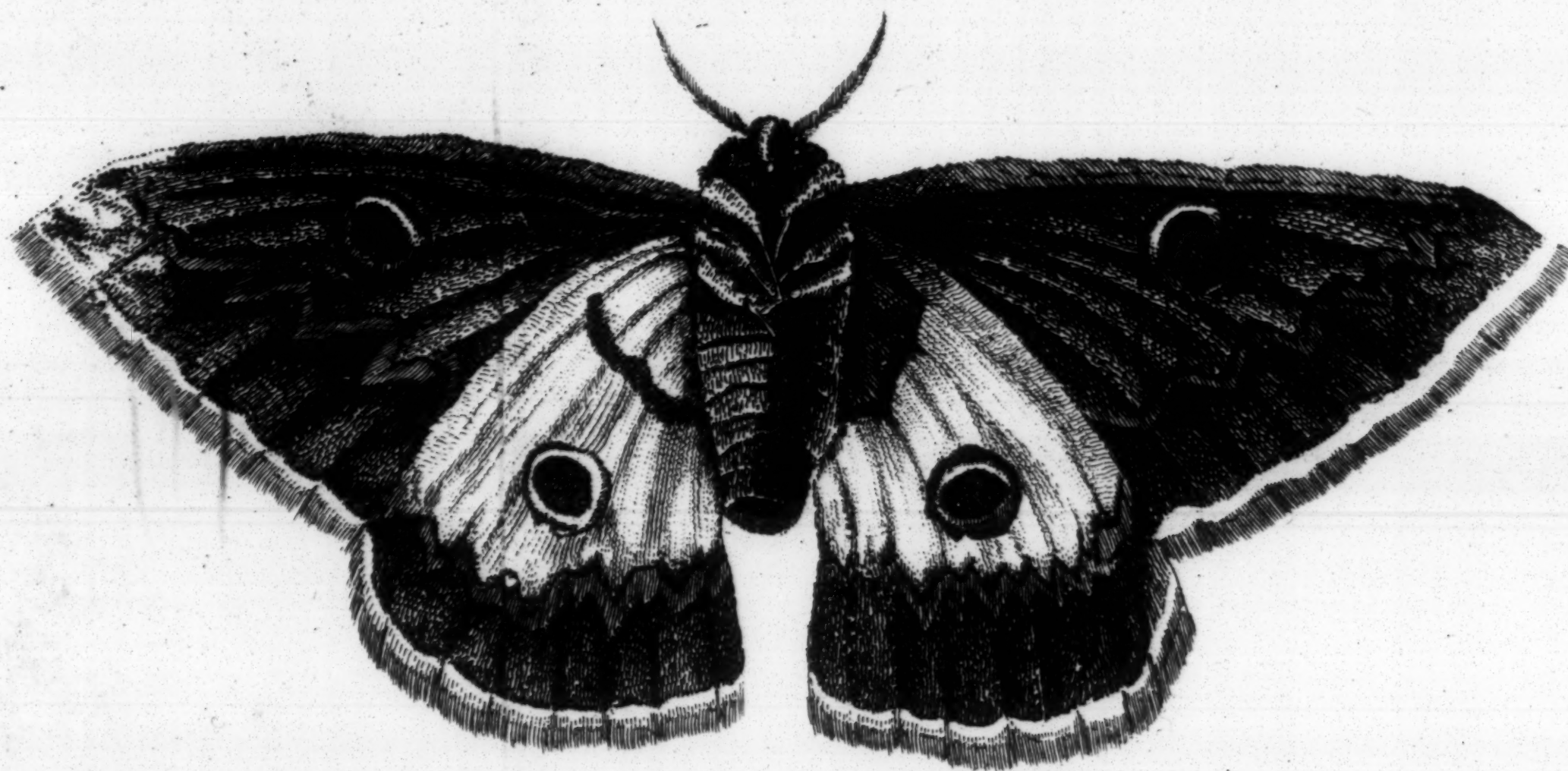
Countess. The *Prior* has given us a very agreeable Image of our own Resurrection.

Prior. All Nature abounds with sensible Images of celestial Things, and the sublimest Truths; and a real Profit perpetually redounds from the Contemplation of her Works. This is a Theology that is constantly well received, because it is always intelligible. The greatest of all Masters, or rather our only Master, has taught us this Method, by taking the chief Part of his Instructions from the most common Objects Nature presented to his View; and in particular, he has given us an Image of the Resurrection, in a Grain of Wheat, that continues unmultiplied till it dies; but as soon as it is rotten in the Earth, produces a large Profusion of Grain.

Countess.



They are distinguishable by the Antennae or horns which constantly lessen into a point.



The Under View of the Papilio's Plumage.

Toms sculp.

Countess. If the Study of those Changes which Insects undergo, could afford us no more than one useful Comparison, our Time, even in that Case, would not be misemployed. But my Servant has brought us the Box I was desirous the *Chevalier* should see: Here is the Key, Sir; be pleased to open it, and divert yourself.

Chev. Are they Caterpillars who are at work in it?

Countess. No: They are Creatures risen from the Graves of those Insects, though Butterflies. their Resurrection has not added Immortality to their new Life. I have collected and pasted here, in different Compartments, all the several Kinds of *Papilio's* I have ever seen; and as I learned to paint when I was very young, I have copied each Animal from Nature, under every Compartment, and have likewise represented the Caterpillar and *Aurelia*, that are proper to each Species, in their natural Colours and Dimensions. Examine the first Compartment you cast your Eyes on.

Chev. What delightful Colouring is here! Pray let us observe them in order, and begin with the first.

Countess. The *Papilio's*, who make their Appearance in the Night, I have ranged upon a Ground of white Sattin. Their Shades and Colours are soft and agreeable, but not very shining; and they want to be heightened with white, to give them a better Effect. As all these Insects only appear in the Night, I call them my *Owl-Papilio's*. You see them painted under Moths. the Compartment, in the same Order.

Those of the first Range represent Moths that gnaw Stuffs.

Chev. They seem to be wrapp'd up in a Kind of Muff, out of which they extend their Heads and Bodies.

Countess. That Muff* is a Habitation which they themselves prepare. The young One, upon leaving the Egg, which a Butterfly has lodg'd upon a Piece of Stuff, or a Skin well dressed, and commodious for her Purpose, immediately finds a Habitation, and Food in the Nap of the Stuff, or Hair of the Skin. It gnaws † and lives upon the Nap, and likewise builds with it the Apartment you see, accommodated both with a Fore-door, and a Back-

* Memoirs of the Academy of Sciences, 1728.

† *Monf. Reaumur.*

one. The whole is well fastened to the Ground of the Stuff, with several Strings and a little Grew. The Moth sometimes thrusts her Head out of one Opening, and sometimes out of the other, and perpetually devours, and demolishes all about her. But 'tis very pleasant to observe, that the Tent of this Creature is always of the same Colour with the Substance she feeds upon; and when she has cleared the Place about her, she draws out all the Stakes of this Tent; after which she carries it to some little Distance on her Back, and then fixes it with her slender Cords in a new Situation. If she has been gnawing red Wool, and should afterwards find herself placed on a Parcel of Wool of a green Dye, her Habitation, which, till then, was all red, is enlarged in its Dimensions, but, at the same Time, becomes tinged with Green, and perfectly corresponds with the Plain where she finds her Pasture. In this Manner she continues to live at our Expence, till she is satiated with her Food, at which Period she is first transformed into a Nymph, and then changes to a Papilio. I would not have the *Chevalier* believe all this to be only an agreeable Amusement. For my part, I was willing, as a good Oeconomist, to have some Knowledge of an Animal so destructive to our Furniture; and this Knowledge has likewise furnish'd me with a Remedy, which is obtained, by frequently rubbing the Tapestry and Curtains with a Lock of Sheep's Wool, that still retains its natural Fat. This Discovery was made by observing, that the Moth always chuses Skins and Wool, that have been manufactur'd by the Workman. Another Remedy is, to beat our Stuffs and Tapestries well, before the Papilio's have laid their Eggs, towards the Middle of the Summer; and to be careful not to replace them in the Apartments, till you have destroyed the Moths and Papilio's with Oil of Turpentine, or the Smoke of Tobacco.

Let us now proceed to the second Compartment, which begins with those Papilio's that appear in the Day. Their Size is generally larger, and their Colours more lively. I always took Care to fix them on a Sattin Ground, of a Colour contrary to that which appears in these Insects. In this, and the next Compartment, you see no Colours but what are simple and uniform; but in the fourth, you
may

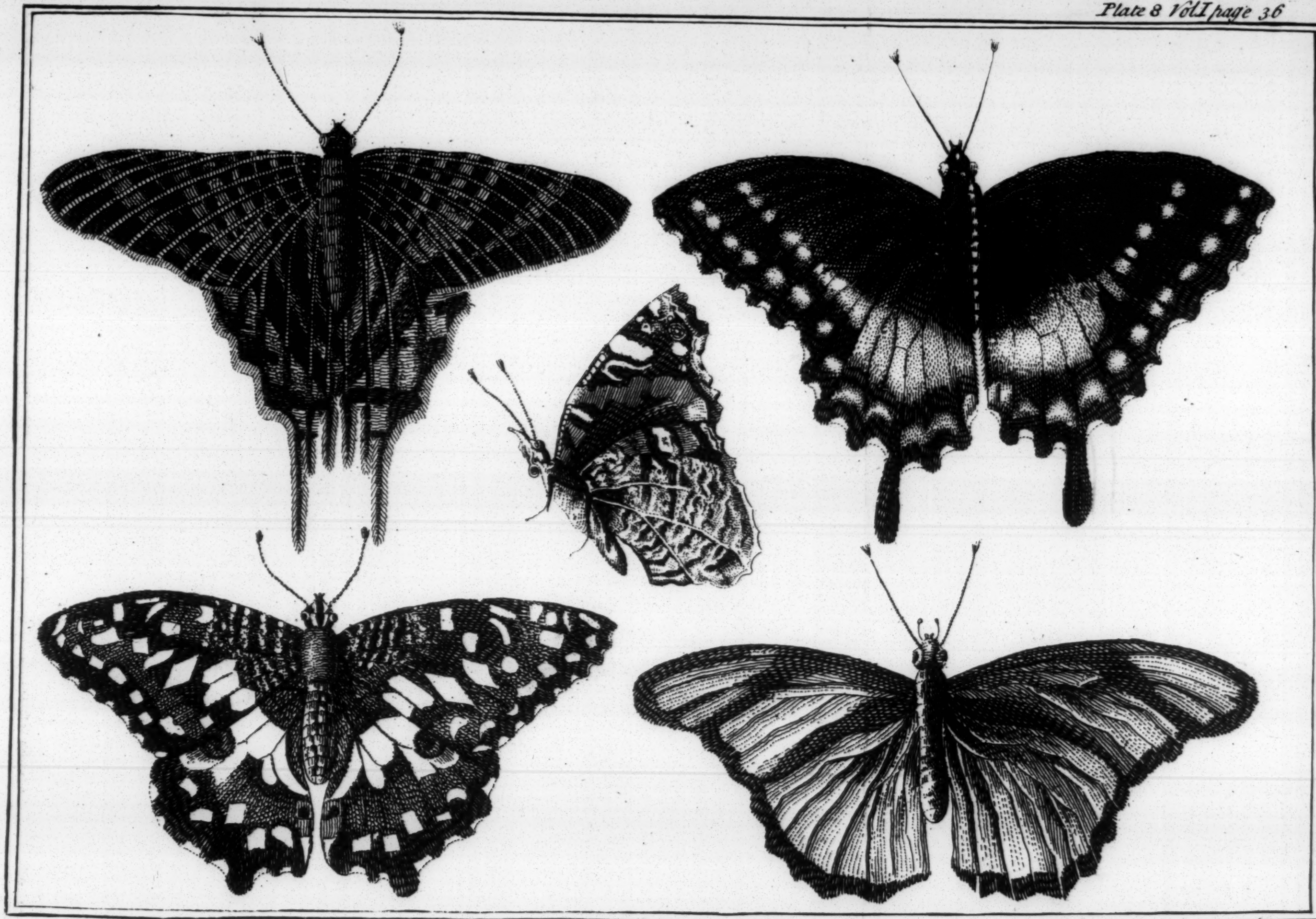


Toms sculp.

They are formed into a kind of Tuft.

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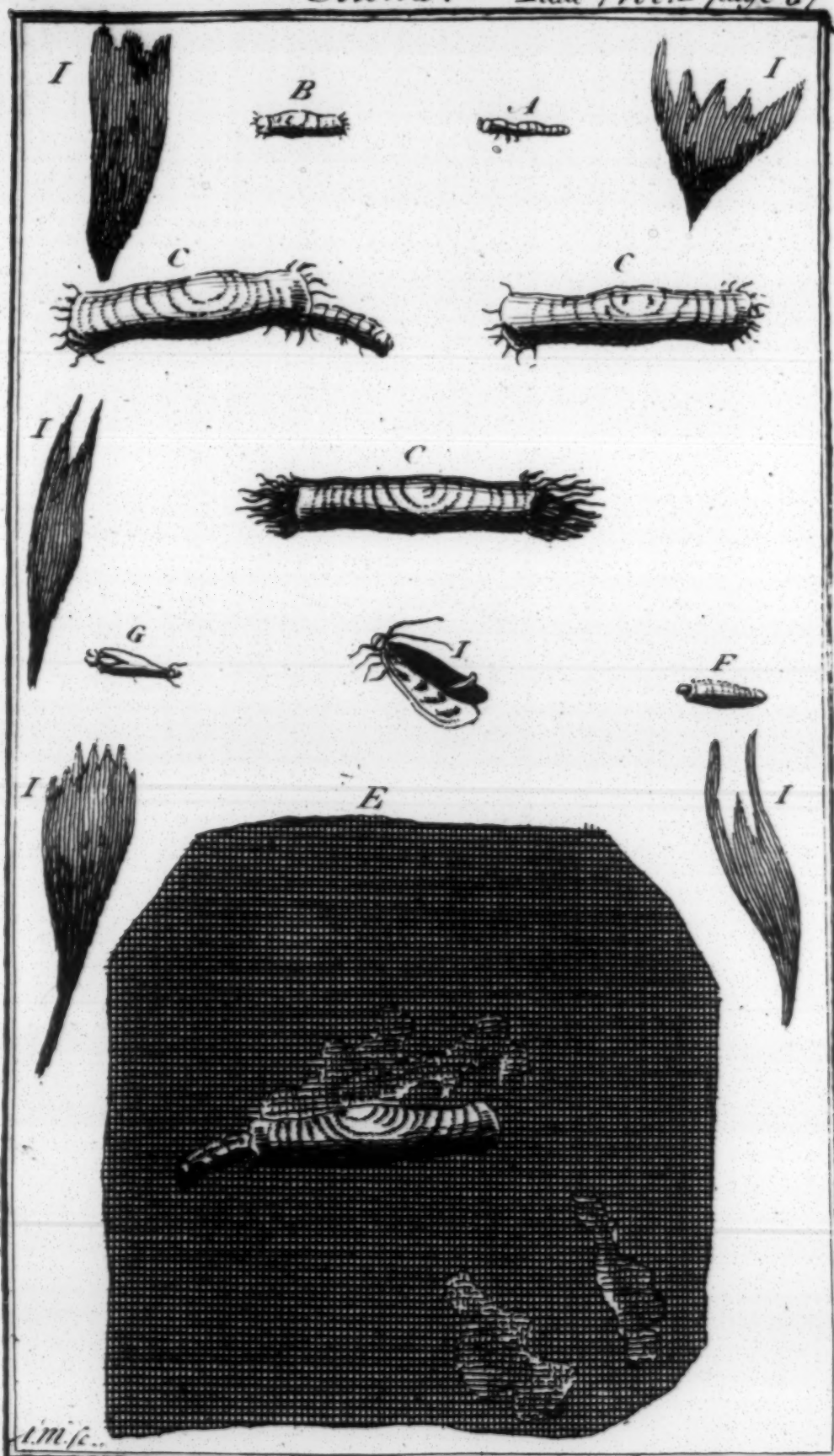
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Papilios of the Day.

Toms sculp.

Distinguishable by their Horns or Antennæ whose Extremities are formed into a kind of Tuft.



A. The Moth. B. Vesture of a Moth. C. The Moth & its Vesture larger than life. D. The Fastenings. E. Stuff gnawed by a Moth. F. The Chrysalis. G. The same view'd from beneath. H. The Butterfly sprung from this Chrysalis. I. The Plumes of all sorts of Butterflies as seen thro' a Microscope.

may observe them intermingled with one another. I have there opposed white to red, and yellow to blue; all these Colours heighten, and contrast each other, according to their different Degrees.

In the last Compartments, I have collected and ranged, with the nicest Judgment and Propriety I was capable of, all those Papilio's who are covered with Plumage, or tintured with a Variety of Colours. You may there see those of *French*, *Indian*, and *American* Extraction; for they have been brought to me from all Parts: Each Country has its own Species, shaped in a peculiar Manner. There is not one of these Creatures that has not a good Effect, when the Eye compares it with the next; and indeed most of them viewed singly, and independent of the rest, give Pleasure to the Sight; sometimes by the rude, and sometimes by the soft Gradation of one Colour into another, and the various Diminutions of the Tints; but, above all, one is astonished at the Beauty of the largest of these Insects, where Nature seems to sport herself in the artificial Mixture and Display of all her most amiable and radiant Treasures. You will find, in these Wings, the Lustre and Variety of all the Colours of Mother of Pearl, you will see the Eyes that sparkle in a Peacock's Tail, and will find all the Edges bordered with the Ornaments of shining Silks, and Furbelows, the blending Dyes of *Hungary* Point, and the Magnificence of rich Fringes. When I have any Furniture, or Dress to adjust, 'tis here I come for Counsel. *Chevalier*, you may take a full View of them, if you please; I only desire you not to press them with your Fingers, lest you rub off the Feathers.

Chev. Feathers, Madam! I should imagine that what a Butterfly discolours us with, could be nothing but Dust. Whenever I have caught any of them, my Fingers were covered with a fine Powder, of the same Colour with the Creature.

Countess. That Powder*, as these Gentlemen have shewn me, is a Cluster of little Feathers ending, at one Extremity, in a Quill, and, on the other, rounded and adorned with Fringe; the Extremity of one covers the Beginning of another. They are fixed in perfect Order, like

* *Leuwenhoek's* Arcan. Nat. p. 3. Epist. 146.

the Feathers of Birds, and when you wipe them off, the Wing that remains is only a fine transparent Film, where you may discover the Sockets in which the Quill of each Feather was sunk. But that you may have no farther Doubt of this Matter, cast your Eyes upon the last Compartment, where I have scattered upon a Lay of Glew, the Dust of all Sorts of Butterflies.

Count. Here's a Microscope, Sir, that will enable you to change this Dust into Feathers.

Cher. Nothing can be more certain than what the Lady has been declaring. Instead of discovering the least Grain of Powder, I see nothing but beautiful Plumes, whose Colours have a Liveliness, and Variety that enchant me.

Countess. Since you are not displeased, Sir, with my Amusements, I will entertain you to morrow with my Silk-Worms. It will give you a real Pleasure to see all the Labourers at work, especially when they are forming their Thread; but unhappily for us, the Time for this Sight is elapsed, and you must defer your Visit till the next Summer, when, I hope, you will favour us with your Company three Months, instead of one.

The End of the second DIALOGUE.

S I L K-

SILK-WORMS.

DIALOGUE III.

The COUNTESS,
The PRIOR, and
The CHEVALIER.

Countess. **T**HE *Count* has taken a little Journey for two or three Days; but for all that we may proceed in our Conferences. Silk-Worms are to be our Speculation To-day; and we can enter upon this Subject without any Assistance from Books or Learning. I have brought up so many of those Creatures from my Infancy, that I am able to entertain you with their Labours, and the Present we receive from them; but 'tis possible the *Chevalier* may be as well acquainted with them as myself.

Chev. I have sometimes heard People speak of them, and several of my Friends breed them up in Boxes; but I was never suffered to have any myself, and was even debarred from seeing those that belong to others; so that one would have imagined these little Animals had been infectious.

Countess. Those were Prejudices indeed. For my part, I have had Silk-Worms all my Life-time; though for some Years past, I have resigned this Amusement to my Daughters: They feed them, keep them clean, and equally share them; they are entirely pleased with this Employment, and never find the least Inconvenience in it, because

because the Insect is very agreeable; and whenever it grows sick, they throw it away.

Chev. I should take it as a very great Favour, Madam, if you would acquaint me how those, who are to be brought up, must be managed; and in what manner you make use of their Labours.

Countess. There are two Methods of Rearing them: You may let them thrive and exult in full Liberty upon the Trees that nourish them: Or you may keep them at Home, in a Place particularly accommodated to that Purpose, taking care to supply them every Day with fresh Leaves. The Prior has made an Experiment of the first Method; and I will desire him to give us his Opinion of it.

Prior. 'Tis true: I had, some Years ago, the Curiosity to make this Use of the Mulberry-trees that grow under my Chamber Windows; and I lodged upon them a Number of Silk-Worms, who succeeded very well without my interfering in the least. They practise the same in *China*, *Tunquin*, and other hot Countries. The Butterflies, who spring from Worms, or rather Caterpillars, who spin Silk, chuse a proper Part of the Mulberry-tree to deposit their Eggs upon; and there they fasten them, with that Sort of Glew which most Insects are provided with, for different Purposes. These Eggs remain there all the Autumn, and Winter, without the least Injury; and the Manner in which they are fixed and disposed, shelters them from the Frosts that sometimes don't spare the Tree itself. The Young consigned to the Care of an affectionate and tender Providence, never quits the Egg till its Sustenance is provided for it, and the Leaves begin to shoot from their Buds: But when once those Leaves are expanded, the Worms break their Shells, and disperse themselves over the Verdure; by Degrees they increase in Bulk, and at the End of a few Months, distribute upon the same Tree, little Balls of Silk, which look like golden Apples amidst the beautiful Green that embellishes and contrasts them. This Method of nourishing them is most conducive to their Health, and occasions the least Trouble; but the Inequality of our Climate makes it liable to many ill Conveniences that are not to be remedied. 'Tis true, we might with Nets, or some other Invention, preserve the Worms from the Depredations of Birds: But the Severity of the cold

cold Season, which suddenly succeeds the first Heats very frequently, and besides this, Rains and violent Winds make a general Destruction. 'Tis necessary therefore to bring them up in the House, in the Manner her Ladyship practises; and I beg the Favour of her to let us into the Particulars.

Countess. We chuse a Room in a good Air *, and where the Sun has a free Admission. This Apartment must be defended from the Blasts, by Windows well glazed, or Frames of strong Cloth. Care must likewise be taken that the Walls be well plaistered, and the Floor very firm. In a word, all the Avenues must be inaccessible to Insects, Rats and Birds. In the middle of the Room you must raise four Columns or Pieces of Wood that may form a large Square. From one Column to the other, several Hurdles, made of Osier Twigs, must be extended in Ranges one above another, and under every Range there must be a Floor, bordered round with a Ledge; these Floors slide into a Groove, and may be fixed or displaced at Pleasure.

When the Worms have left their Eggs 'tis customary to spread some soft Leaves of the Mulberry Tree over the Linen or Paper of the Box, where they were hatched, and which is then large enough to contain a great Number of them. When they have gained a little Strength, they must be distributed upon Beds of Leaves, along the Ranges of the Square, that is in the middle of the Room, and round which there should be a free Passage. They fasten upon the Leaves, or else on the Osier Twigs, when they have eaten the Leaves. They are furnished with a Thread, by which they suspend themselves as they have Occasion; and by this means avoid the Shock of a Fall. Every Morning they must be supplied with fresh Leaves lightly scattered over them in an uniform Manner. The Silk Worms, upon this, immediately quit the old Leaves, which must be all removed, and care taken that the Insects be not carried away with them; and therefore 'tis necessary to employ a discreet and diligent Servant, whose Business must be to feed and keep them clean in a proper Manner; for nothing injures these Creatures so much as Moisture and Im-

Their Su-
stenance.

* Marc. Hieron. Vida Bombyc. c. 1.

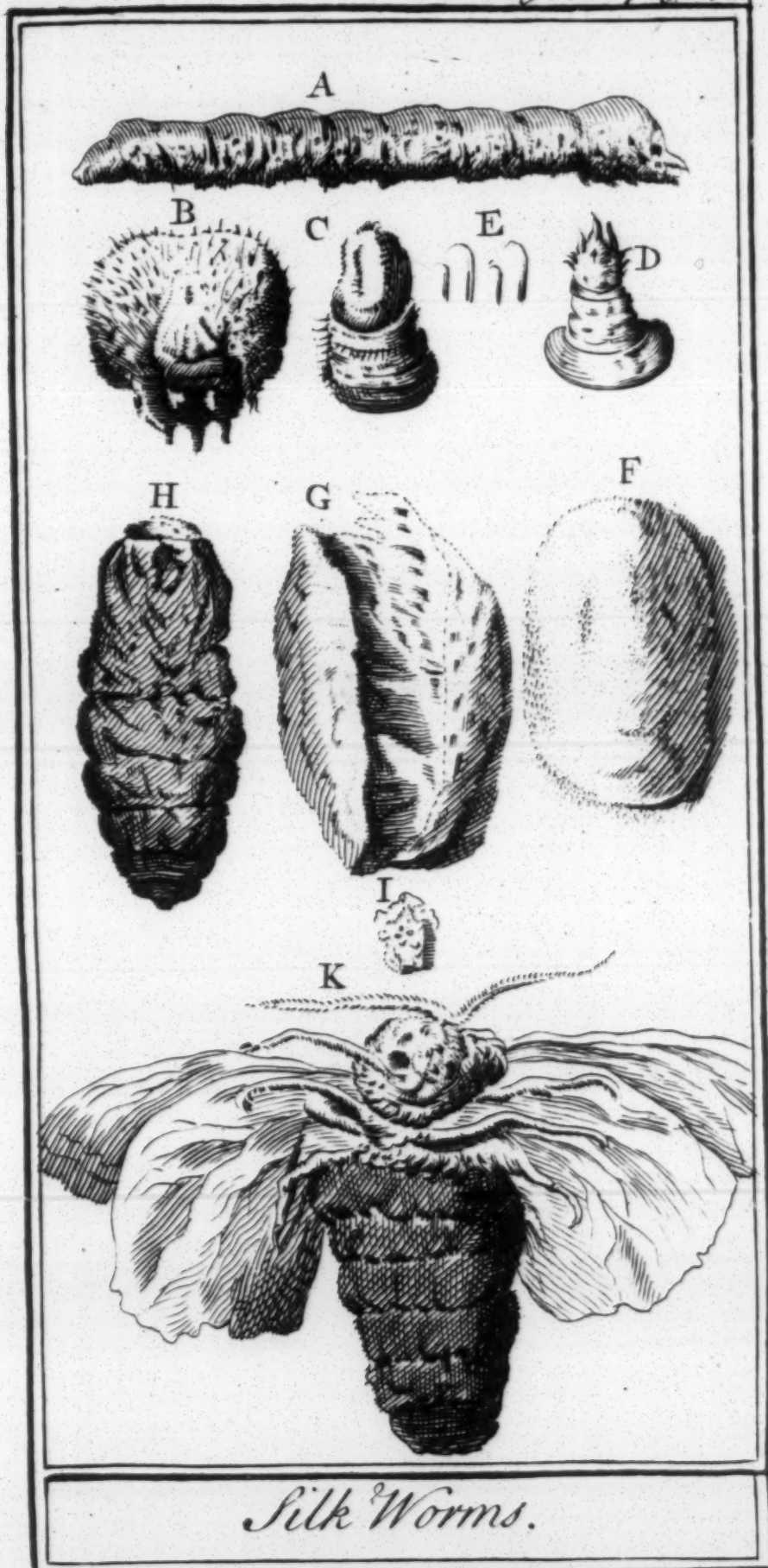
purity. In order to preserve them from the Distempers to which they are subject, the first Care of the Governess should be, to gather Leaves for them in a dry Season, and preserve them in a Place where no Moisture can come; she must likewise do this before the Rains fall, that she may not be obliged to dry the Leaves, and make her young Nursery sometimes fast, which would soon be very prejudicial to them; for these minute Animals being to live but a short Period, make the best of their Time, and are always eating to the very last Season of their Moulting; after which they continue to live almost as much longer without feeding at all. When the Mulberry Leaves happen to fail, you may, till there is a new Supply, give them the Leaves of Lettuce or Holly-Oak, tho' this is a Collation they have very little Relish for. Necessity alone obliges them to submit to it; and the Silk they then spin has evident Marks of the Cessation of their usual Food, and proves but indifferent.

There is another Precaution almost as necessary as the Choice and good Management of their Provisions, and that is, to let fresh Air into the Room from Time to Time, in a fine Sun-shine; and to keep as neat as possible, not only the Floors appointed to receive the Fragments of their Leaves and other Impurities, but likewise all the Place in general.

Cleanliness and good Air greatly contribute to their Welfare and Growth. We now come to the different Stages through which they pass.

The Worm, when it leaves the Egg, is extremely small, it is likewise perfectly black; but its Head is of a more shining Sable than the rest of its Body. In a few Days it begins to assume a whitish Hue, or an Ash Gray. After this, its Coat fullies, and becomes ragged, at which time the Animal casts it off, and appears in a new Habit. It increases in Bulk, and grows whiter, tho' a little tending to the Green, with which it is replenished. After a few Days, the Number of which varies according to the Degree of Heat, the Quality of its Food, and the Constitution of the Animal, it ceases to feed, and sleeps almost two Days; at the End of which 'tis exceedingly agitated and tormented, and grows almost red with the Efforts it uses. Its Skin wrinkles and shrinks into Folds, and the Insect then divests itself of it a second Time, and throws it aside with its Feet. It now
appears





Silk Worms.

appears in its third Habit, and very magnificent it is, considering it is furnished out in the Space of three Weeks or a Month. It begins to eat again, and you would then take it for another Animal, so different are its Head, its Colour, and whole Form, from what they were before. After it has continued eating for some Days, it relapses into its Lethargy; at the Conclusion of which it quits its Covering, as usual: That is to say, it divests itself of three different Skins from the Time it leaves the Egg. It continues feeding some Time longer; and at last entertains a Disrelish for the World and its Enjoyments: It renounces all Feasts and Society, and prepares for Solitude, by building with its Thread a little Cell of a ravishing Structure and Beauty. But before I introduce it into this Mansion, I should be glad to be informed by the *Prior*, who has carefully examined all these Operations, what is the inward Arrangement of a Silk Worm's Body; and from whence it receives the Materials of that beautiful Thread it presents us with; and how the Creature manufactures it. You learned People discover that with your Glasses, which eludes the most attentive Eyes.

Prior. In a few Words, Madam, this is the Anatomy of a Silk-Worm; at which your Ladyship may assist with all imaginable Decency. This Worm, like other Caterpillars, is composed of several elastick Rings, and is likewise accommodated with Feet and Claws, to fix itself in a convenient Situation. It has a little Skull to cover the Substance of the Brain, which descends and is communicated by small Vertebrae, from one Extremity of the Body to the other.* It has two Rows of Teeth in its Mouth, which don't move up and down like ours, but work from the Right to the Left: These Teeth enable it to saw and dilacerate the Leaf. When the Animal cuts it, she presses one side of the Leaf, and proceeds with a slanting Motion, as we ourselves would cut it with a Pair of Scissars, by continuing from the Top to the Bottom†. One may easily distinguish the Palpitation of its Heart, which cannot be performed without proper Vessels to cir-

The Anatomy of a Silk-Worm.

* Leuwenhoek, Arcan. Nat. Tom. iii. Ep. 146.

† Malpighi. Ibid.

culate a Fluid through the whole Body. From the Head to the Extremity of the Tail, is extended a kind of little Nerve, which we call the Spine; because

The Spine. it incloses, in the Joints that form it, a Marrow like the Brain: This Spine that is placed in the Middle of the Body, and continued thro' its whole Length, sustains the Heart and

The Heart and Lungs. Lungs. The former of these is a Tube extended through the whole Length of the Worm, and is composed of several minute Cells, which enlarge the Middle, and diminish at the Points of Contact, and is composed of many oval Vessels. The Lungs are a double Chain extended on each Side, and composed of several Rings which correspond with the Orifices we see distributed along the exterior Sides of the Worm. It is through these Openings that the Air flows into the Lungs, and by its Spring and Expansion, promotes the Circulation of the Chyle or Humour which nourishes the Silk-Worm, as we have found by Experience. Drop a little Oil upon the Head, the Back, or Belly of this Insect, it will still continue alive; but if you rub Oil, Butter, Sewet, or any other such fat and thick Matter, on the Sides of the Creature, you then obstruct the Vents, which convey the Air to the Lungs: and accordingly it immediately falls into Convulsions and dies, unless you relieve it by renewing the Communication of the Air.

Between the Heart and Lungs, are the Ventricles and Intestines, where the Digestion is performed.

The Intestines

The whole System of these Vessels is incompassed with almost innumerable Folds and Windings, formed by a very long and slender Bag, which contains a sort of Gum, coloured like a Marigold, of which the Worm makes its Silk.

The Bag of Gum.

You may have sometimes seen in the Work-Rooms of Goldsmiths, or Gold Wire-Drawers, those Iron Plates that are pierced thro' with Holes of unequal Dimensions, thro' which they draw, and lessen at Pleasure, Gold or Silver Wire. These Plates are called Wire-drawing Irons. The Silk-Worm has under her Mouth such a kind of Instrument perforated with a Pair of Holes, thro' which she draws two Drops of the Gum that fills her Bag

Bag. These are like a Couple of Distaffs, that continually supply the Materials out of which she spins her Thread. She fixes both these Drops where she pleases, and then draws back her Head, or lets herself fall. The Gum that flows thro' these Openings, receives their Form, and lengthens into a double Thread, which immediately loses the Fluidity of the Liquor that composes it, and acquires a Consistence sufficient to sustain or enfold the Worm at the proper Season. She is never deceived in adjusting the Dimensions of the two Apertures, or calculating the due Thickness of the Thread: She always makes the Strength of it proportionable to the Weight of her Body. She unites the two Threads by glewing one over the other with her fore Paws; and when the Time for making her Cone comes, she employs the Fingers that her Paws are furnished with, in either twisting or glewing the two Threads together, or fixing her Silk sometimes in one Place, and sometimes in another; and I assure you I have frequently stood still to observe the graceful Attitude in which she spins, as well as the Industry that shines through all her Work.

Their manner of Spinning.

It would be a very curious Thing to know how this Gum which composes the Thread, is separated and drawn off from the other Juices that nourish the Animal. It must be accomplish'd like the Filtrations and Secretions of some Humours formed in an human Body. I am also persuaded that the Silk-Worm, at the Entrance into the long Bag we have been describing, is furnished with a Set of little Glands, which being impregnated with Gum, afford a free Passage into the Bag, to all the Juices of the Mulberry Leaf that correspond with this glutinous Matter, and exclude every Fluid of a different Quality. As to the Remainder of the Aliment, one Part, by Virtue of its Fineness, is received into little Vessels which convey the Chyle, or nutrimental Juices to the Heart. The other Part, which is the Dregs, meets with Passages proportioned to its Grossness. But I tire you with my Dissertation, and find, that, whenever the *Countess* is silent, 'tis all lost Time to the *Chevalier*.

Chev. Let me have your Ladyship's Permission to contradict the *Prior* a little. I never had a Moment's Uneasiness

finess in his Conversation, and when I find any Difficulty in his Descriptions, I am eased of it by bringing him upon the same Subject another time. But I confess I am very impatient to know, how Silk-Worms and other Caterpillars, wrap themselves up in their own Thread, and work it into an Habitation or a Tomb.

Countess. I have picked up by Chance three* or four Cones of those Worms, who finished their Work much later than the rest. They are laid in a Paper, and I must give the *Chevalier* a Sight of them.

Chev. How, Madam? are the Silk-Worms within?

Countess. Yes, like Solitaries in so many Hermitages; let us take the Scissars and cut open the Cones.

In the first Place, take Notice of the Down or Flue, which is the Heap of bad Silk you see there, scattered at a Venture, and taking up a great deal of Room. In the next Place, you may see the fine Silk all compact, and ranged with the utmost Propriety. And lastly, observe the Shell, which is a Composition of Silk and Glew, and resembles a very strong Stuff. Within that you will find the Worm in Miniature, and changed into a *Nymph*. Take it in your Hand.

Chev. 'Tis made like a Bean, without Feet, Head, or any distinct Part: One may see, however, several little Rings that gradually diminish towards the Extremity, and have some Motion when they are pressed.

Prior. 'Tis the *Nymph* that incloses the Body of the Butterfly: The Wings, Feet, Eyes, Horns are all there now: but in a manner not to be distinguished. Fifteen Days hence the whole will be disengaged.

Chev. But if the Silk-Worm is concealed under the Down, when she spins regularly, how is it to be known in what manner she has raised all this Work?

Countess. Nothing is more easy: When the Creature is satiated with Leaves, and the Time for its last Transformation is arrived, it seeks for a Place where it may build itself an Abode without Interruption. We usually give it some little Stalks of Broom, or a Piece of Paper rolled up, into which it retires, and begins to move its Head to different Places, in order to fasten its Thread on every Side.

* The Cone is a Ball of Silk in which the Worm enfolds itself.

All this first Work looks like Confusion, but it is not without Design. The Worm neither arranges its Threads, nor disposes one over another; but contents itself with distending a sort of Cotton or Flue, to keep off the Rain; for Nature having ordained them to work under Trees, in the open Air, they never change their Method, when they are even rear'd in the House.

When my Curiosity led me to know how they spun and placed their beautiful Silk, I took some of them, and frequently removed the Flue, with which they first attempted to make themselves a Covering; and as I weaken'd them exceedingly, when they were at last tired with beginning a-new, they fastened their Threads upon what came in their way, and began to spin very regularly in my Presence, bending their Heads up and down, and then crossing to every Side. The Worm, at that time, confined its Motions to a very contracted Space, and by Degrees had entirely surrounded itself with Silk. The Remainder of the Operation is invisible, but one may guess how it was accomplished. The Animal, to finish its Mantle, drew out of its Bag a Gum, which it spun into a less delicate Silk, and then thicken'd it with a strong Glew, which served to bind all the last Ranks of this Silk over one another.

Here then are three Coverings entirely different, which afford her a Succession of Shelter: The Flue keeps off the Rain; the fine Silk forms a Tissue that prevents all Access of Air; and the glew'd Silk, which composes the thick Shell that touches the Worm, not only repels the Water and Air, but also renders the Inside of this Habitation inaccessible to the Cold. After she has been in this Retreat long enough to be changed into a *Nymph*, by divesting herself of her fourth Skin, and to be transformed, from a *Nymph*, into a Butterfly, by a gradual Expansion of her Horns, Wings and Feet, that were glew'd up and enfolded in the *Nymph*, as in a Case, 'tis then time for her to make her Appearance.

Chev. That must be a difficult Affair. Is she provided either with Saws, or a Gimlet, strong enough to pierce through the Shell, the Silk, and the Down? In my Opinion she seems to be strongly immured.

Countess. That Being who teaches the Worm how to build herself a Place of Rest, where the delicate Limbs
of

of the New Animal may be formed without Interruption, instructs that Animal likewise how to open a Passage for its Flight. The Cone is like a Pidgeon's Egg, and more pointed at one End than the other. The Worm does not interweave its Silk towards this Extremity, nor apply its Glew there, as it does in every other Part, by bending itself all around, with great Pliantness and Agility; and lastly, she never fails to fix her Head opposite to the pointed Extremity; and I will acquaint you with the Reason: This Part is not so strongly cemented, nor exactly closed as the rest. She is conscious, this is to be the Passage for the other Animal she carries in her Bowels, and has therefore the Precaution never to place this Extremity, or pointed End, against any Substance that might obstruct the Creature at the Season of its Egress. When the Worm has exhausted itself, to furnish the Labour and Materials of these three Coverings, she resigns her Form of a Worm, her Spoils drop all around the *Nymph*, who is not converted into a perfect Butterfly, till the Expiration of fifteen Days, or three Weeks, and sometimes a longer Space of Time. This new Animal, when its Formation is compleated, extends its Horns, together with its Head and Feet, towards the Point of the Cone, which, not being closed up in that Part, gradually yields to its Efforts: it enlarges the Opening, and at last comes forth. At the Bottom of the Cone, the Ruins of its former State are to be found, I mean the Head and entire Skin of the Worm, which then bear some Similitude to an Heap of foul Linen. I forgot to acquaint you, that the Butterfly, before it quits its Repository, frees itself from the superfluous Humidity, which before contributed to form and fortify its Limbs. This Evacuation soils the Ball, and very much damages the Silk.

Cher. What becomes of the Butterfly after this?

Countess. It wanders, but a little Distance, from the Place it quitted. The Male is more lively and smaller than the Female. She is larger, because she is full of Eggs, which she lays a few Days after; and if they have an Prolificness, they change their Complexion at the Approach of Spring, from a yellow Citron to a bluish Cast, and afterwards an Ash Grey.

Chev. At present, Madam, I am anxious to know in what Manner you wind off the Silk, and how you use it. For if the Butterfly, before it forsakes the Cone, discharges a Liquor that corrupts it, and if she likewise pierces a Hole thro' it, it must certainly be all spoiled.

Countess. That is true; but there is no Use made of those Cones which are pierced in this Manner; and besides this, Care is taken to prevent that Inconvenience. A Female Silk-Worm sometimes lays above five hundred Eggs. You see we need but a very small Number of *Nymphs*, to stock the Laboratory for the ensuing Year. And the other Cones, from whose Silk we propose to make any Profit, are exposed in the open Sun-shine, which, in Spite of all these different Tissues, penetrates to the *Nymph*, and kills her in less than six or seven Hours, and before she has spoiled any thing.

Prior. The *Chevalior* will be dissatisfied, unless we likewise teach him how to wind off the Silk.

Countess. When we intend to separate the Silk from the Cones, the Down must be cleared away in the first Place; and the Cones, with their Silk, are then thrown into warm Water; where they are stirred about with Twigs, in order to come at the Heads or Beginnings of the Silk. These are drawn through little Rings, to prevent the Cones from rising too high, when the Silk is fastened to the Reel, and you begin to wind it. They also join together the Silk of several Cones, to a certain Number, as six; but generally eight, and sometimes more, according as the Silk is intended to be made more or less strong. The Cones remain in the Water till they cease to furnish any more Silk. But those who wind it, don't wait till it is all exhausted; because it changes its Colour and grows weaker toward the End. But even this last Part of the Silk is not without its Beauty, and they wind it off by itself. As to the Cones, they are useful on several Occasions. Some People stain them with a Variety of Colours, and form them into artificial Flowers, which are sometimes finished with the utmost Perfection. The common Practice is, to leave them in the Water, till all the Glew be evacuated, and then they are carded like Wool, and yield a kind of silken Flax; which is spun with a Wheel, in order to weave it into Stuffs of a moderate Value. But I am very indiscreet to trouble you with all the

Particulars of this Work. Make the *Prior* a Visit, Sir: He has invented a Reel of a particular Form, with which you may learn to wind off the Silk very judiciously.

Prior. It was merely to satisfy her Ladyship's Curiosity, and to know the exact Length of the Silk produced by these Worms, that I ordered a little Reel to be made, each of whose four Sides, contains three Inches in Length. But since I have compleated my Experiment, I renounce the Trade for the future.

Countess. But what do you gain by these Dimensions.

Prior. The four Sides, taken together, are equal to twelve Inches, or a Foot; I am sure then, that each Turn of the Silk, upon the Machine, is equivalent to that Measure, and sometimes a little more; because the Rounds are enlarged, when they fold over one another. At every Turn of the Handle, I wind off a Foot of Silk; I have only then to reckon, how often I turn the Handle of the Wheel for one Silk-Worm, in order to know, at the same Time, how many Feet it produces.

Countess. You are certainly in the Right; and have you made the Experiment, Sir?

Prior. I made it upon two Cones of Silk, and found nine Hundred and twenty-four Feet in one, and nine Hundred and thirty in the other. Take Notice, if you please, that the Thread is double, and glewed one over the other, through its whole Length, which consequently amounts to near two Thousand Feet of Thread.

Countess. We must only compute nine Hundred and thirty, because we receive the Thread in the same Condition from the Silk-Worm. I assure, you, Sir, I did not expect half that Quantity, and entirely depend upon your Exactness.

Prior. Besides this, I made another Remark: I weighed the nine Hundred and thirty Feet of Silk. The *Chevalier* knows that a Pound contains two Marks, a Mark eight Ounces, an Ounce eight Drams, a Dram three Penny-weights, and a Penny-weight, four and twenty Grains; which last is a Weight so inconsiderable, that a Breath of Wind easily wafts it away. The nine Hundred and thirty

* Boyle de Subtilit. Effluv.

Countess. Do you know the Difference between this Thread, and that which is made by the expertest Spinster in the World?

Chev. The same that there is between a Rope, and a String of Packthread.

Countess. Rather say, between a needleful of fine Thread and the largest Cable. But let us take a Walk, Gentlemen, and enjoy the Benefit of the Air. What shall be the Subject of our Conversation To-morrow?

Prior. What your Ladyship pleases to appoint.

Countess. In Reality, I am very much tempted to be one of your Party. But it shall not be said, that you admit me into your Society merely to do me Honour. I will be faithful to the Laws of the Company, and intend to assist regularly at your Assemblies; but, if you please, it shall be upon Condition, that you confine your Speculations to my Capacity: As many Remarks as you please on the Things I know. Let us talk of Gardens, Herbs, Fruits, and domestick Animals: I have some small Acquaintance with what we see every Day; but pray don't pretend to make me soar to Heights I can never reach.

Prior. You, yourself, Madam, shall be our President and regulate the Subject of our Conferences.

Countess. I take you at your Word; and if you please, we will pursue our Subject of Spinning: A few Days ago, you described a Spider's Manner of working, and may remember the Pleasure with which your Account was received. No one expected to find so much Skill and Novelty, in any Animal who makes such a disagreeable Appearance. *Chevalier*, I promise you this Description for your Entertainment To-morrow; but advise you to do one Thing in the Interim.

Chev. What may that be, Madam?

Countess. To pass away a little Time with some Weaver; they are numerous enough in this Country, and it may be proper for you to be very exact, in observing how they make our Cloth, that you may the more easily comprehend the Description, the *Prior* will give us, of a Spider's Method of working; in Reality, the one will assist you to understand the other: You must expect, indeed, to see

very poor People ; but their Trade will give you abundance of Satisfaction. The Invention of it is ancient, though it will appear a Novelty to you, and you will discover Ingenuity enough there, to return very well satisfied with my Advice, as well as with what you shall happen to see.

Chev. Will your Ladyship be pleased to let me take one of your Servants with me, to shew me the Way ?

Prior. With your Permission, Sir, I shall charge myself with that Care, and it's proper I should be there, to serve you as an Interpreter. These Good People speak a Language you are quite unacquainted with, and I am not very certain they will understand yours.

Countess. *Chevalier*, pray accept of these two Crowns, perhaps, you may be unprovided with Money, and it is proper to make them a small Acknowledgment ; when you speak to them by a Present, you need no other Interpreter.

The End of the third DIALOGUE.

SPIDERS.

S P I D E R S.

DIALOGUE IV.

The COUNTESS,
The PRIOR, and
The CHEVALIER.

Countess. **C**hevalier, before we come to your Insects, I should be glad to know your Thoughts of a Weaver's Loom; do you now distinguish the Warp* from the Woof†.

Chev. I am Master of all this, and can tell you the Use of the Treadles §, and Stays ||, as well as the Comb ‡, Shuttle **, and ———

Countess. He is going to tell us the Name of every Part of a Loom. I fancy you did not think your Entertainment low, or disagreeable.

* The Warp is the Thread which is fixed on the Loom.

† The Woof is a Thread that passes with the Shuttle cross the Warp.

§ The Treadles are Pieces of Wood which the Weaver alternately lowers with his Feet, in order to raise, and fall the Stays.

|| The Stays are two Ranges of Threads hung on Pullies, the Working of which alternately, raises and falls some Part of the Thread of the Warp.

‡ This Instrument is a long Comb, cross which pass all the Threads of the Warp, and which serves to compact the new Thread with the preceding.

** The Shuttle is a little Instrument made of Box, in Form of a Ship; in the Middle of which the Weaver inserts the Woof, that plays off through a little Hole.

Chev. Nothing ever amused me better, and I am very desirous of seeing all the Implements of each Artisan one after another. I cannot comprehend why they should be concealed from us. If by Chance you stop to take a View of an Handicraft's-man's Work, you immediately meet with People, who, with a very serious Air, ask you what you are amusing yourself with, and give you to understand, that you are attentive to what is much beneath you.

Countess. I am exceedingly pleased with the *Chevalier's* Chagrin, they may make a great Affair to him, if they please, of his *Latin*, and other necessary Sciences; but why should he not be likewise permitted to amuse himself with the most common Employments of Life, that are constantly practised?

Prior. There would be something much above a mere Amusement, to be gained by it. The Judgment would be cultivated, because it would acquire just Ideas of every Thing, in an agreeable Manner. The View of Arts and Professions, and of Men in all Situations and Employments, affords a perpetual Source of Experience, entirely calculated to give Instruction, without Expence, or Fatigue. We there learn not only whatever is capable of enriching the Mind, and embellishing Conversation, but likewise that which makes a Man useful, and of Consequence upon all Occasions. Her Ladyship's Son, who is certainly one of the most refined and amiable young Gentlemen one can possibly see, has been educated in this Taste. After he had been compleatly versed, by different Masters, in all the necessary Tongues and Exercises, the Article of travelling began to be thought of; but the *Count* would not suffer him to go to *Germany*, where he now resides, till he had devoted every Morning, for a whole Year, in the Study of Natural Philosophy, or the most amiable Parts of Nature; and besides this, his Afternoons were generally employed in observing, as well as learning, to a certain Degree, the noblest Trades and Professions, without disdaining even the most common. He never passed a Week without going to School at some Shop in *Paris*, not in a superficial Manner, but by making it his serious Endeavour to get a competent Idea of the real Object, and most valuable Method of each particular Trade. He attended a Gold-

Gold-Wire Drawer, a Printer, a Clock-maker, and a Dyer, for near three Weeks. He bestowed as much Time on a Joyner, a Smith, and even a Carpenter; and never left his Man, till he had seen him in all the Forms and Undertakings of his Profession. The repeated View of the same Works, the plain Conversation of the Artisans, the Approbations, or Complaints of the Masters, the various Difficulties, Precautions, and Remarks of the Buyers, made every Art and Trade so familiar to him, that at present he knows each Particular that relates to the Commerce of Life, as well as even those by whose Labours it is supplied: He knows the Names and Use of all the Tools, is acquainted with the Materials employed by the Workmen, as well as the Countries that produce them; he understands the Marks of their good, or bad Qualities, and what they are worth, either at first, or second Hand. He can distinguish the Touches of an Artist, and discern the Difference between a Work of Solidity and good Taste, and one that only strikes the Eye, and is of slight Texture. A dishonest Workman can never impose upon him; but then he likewise knows how to do Justice to the Performance of an able Master: Nay, he goes farther, he is an Artist himself, and makes whatever he has Occasion for, with his own Hands.

Countess. I allow you to enlarge on my Son's Commendations, because you have so great a Share in them yourself. I have infinite Obligations to you, Sir, and can't imagine what peculiar Dexterity you practise; but when you used to disengage yourself a few Hours sometimes, from your common Employment, to take a Walk with my Son; you gave him a Taste of the Manufactures and Sciences, in a Manner that charmed him. Your Method, as it appears to me, was not so much to make him understand, at once, a Set of Sciences, as to raise in him a Desire to understand them; your Intention was to make him curious, because Curiosity is an active Passion, that can never be indolent; and when this Point is once accomplished, all the Rest come without Reluctance or Dislike. I have frequently taken Notice, that your Discourses, and Compliances, nay your very Diversions, only tended to sharpen the Youth's Curiosity. It was very pleasant, for Instance, to see the Curate and his little Parishioner

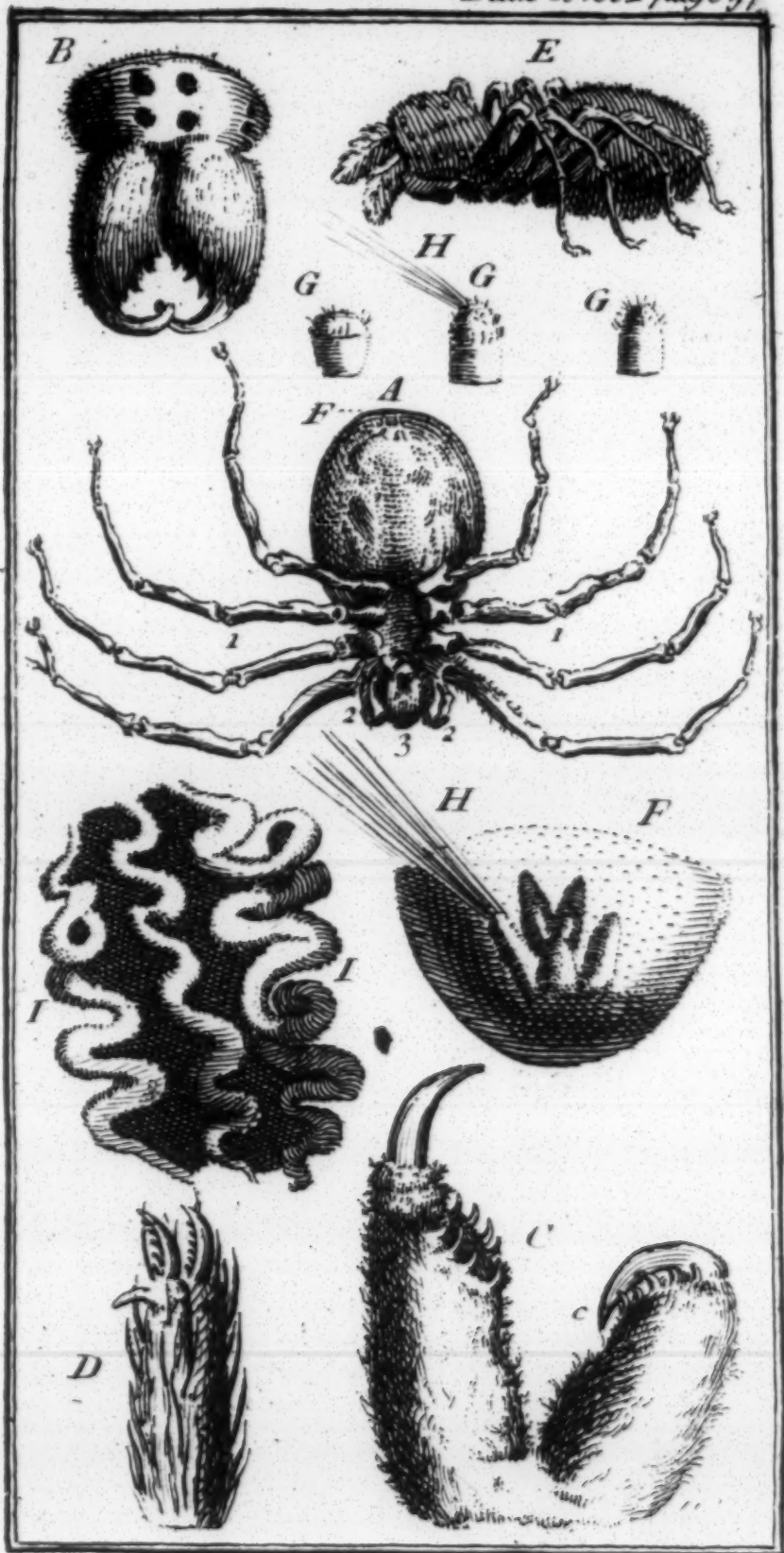
disputing, sometimes by the Water-side, which Stones were the flattest; and then to observe each of them raise his Heap; and, with a Kind of Emulation, skim the Stones along the Surface of the Water; and when they were weary of their Employment, to sit down and make Dissertations on the Descent of Bodies, the Level of the Water, the Lines of Incidence and Reflection, as I think they called them, the Pressure of the Air, and several other Matters that are slipp'd out of my Memory. When this Dialogue was over, they went to work with their Sticks, on the first smooth Bed of Sand they saw, there they traced out the *Holy Land*, *Italy*, or *France*, and even proceeded to the *Indies*, and *Canada*; and if they wanted Sand, they made use of Stones, Leaves, and Apples, with which they sketch'd out Provinces, Mountains, or Cities: Every Day produced some new Invention. 'Tis impossible to describe the Air, and Delight, with which my Son repeated these Performances in my Presence; every thing was so familiar to his Imagination, and so well methodized in his Mind, that whatever he learned in this amusing Manner, was repeated to me in a very exact Order, and the *Prior*, without knowing it, gave Instructions to two Persons instead of one.

Prior. As I was his Pastor, I could not bestow my Time better, than in devoting some of my Care to his Improvement; but when one meets with a fine Genius, it is impossible to be too sedulous in preserving it from every disagreeable Impression. And I can assure your Ladyship, I have employed no Part of my Time with so much Advantage, as those Hours I have pass'd away in little Amusements with this amiable Youth.

Countess. There are but too many, whose Amusements are no more than Trifles, and indeed few are capable of giving them an agreeable Turn, or know how to mix Design with their Diversions, and promote Virtue by the Mediation of Pleasure.

Chev. I must give you, Madam, another Instance of the *Prior's* Abilities. When he had explained to me, Yesterday, all the Parts of a Loom, and shewn me how they were used: *Well, Mr. James*, said he, to one of the Workmen, *will you let me have your Place? It is my Turn to Day*. Upon which he immediately put the Treadles and
the





A. Nette sc.

Spiders.

the Shuttle in Motion, promising to pay Ten-pence for every Thread he should happen to break. After which he asked me, If I would *handle the Loom on the same Terms? Why not*, replied I? Upon which the Gentleman gave me his Place, and I began to work; but —

Countess. Didn't you spoil all?

Chev. It went on very indifferently at first, and I paid the Fine agreed upon, which cost me some Money; but I was in a little Time as dextrous as another. Our good People were highly delighted to see their Work all wrong, and every broken Thread, was as good to them as a Victory.

Prior. Well; let us talk no more of the *Prior* and the Weavers, but come to the Web of another make, that requires neither Loom, nor Shuttle; her Ladyship will not be offended if I describe the Spider and her Tools, before I speak of her Work.

Countess. Go on, Sir; you may talk of Dragons and Serpents, who are as little disagreeable to me; for the Description of the most frightful Object is capable of creating Pleasure.

Prior. There are five Sorts of Spiders*: First, the House Spider, who hangs her Web in neglected Apartments: Secondly, the Garden Spider, who weaves, in the open Air, a little round Web, the Center of which is her Situation in the Day-time: Thirdly, the Black Spider, to be met with in Cellars, and the Cavities of old Walls: Fourthly, the Wandering Spider, who has no settled Nest, like the others: Fifthly, the Field Spider, which they call the Long-legs.

All these Animals have something in common with each other, and likewise something that distinguishes them. Let us, in the first Place, consider what they all agree in.

Every Spider has two Parts, of which the Fore-one, that contains the Head and Breast, is separated from the Hinder-part, or Belly, by a Ligature, or very slender Thread. The Fore-part is covered with very strong Scales, and so are the Feet, which are inserted in the Breast. The hin-

The Fore-part
of a Spider.

* The Memoirs of the Academy of Sciences. M. Homberg. *Leuvenhoek's Arcan. Nat.* Tom. iii. Epist. 135. Lister de Aran.

der Part is cloathed with a very fine and supple Skin, and the whole invested with Hair. In different Parts of their

The Eyes. Head, they have several fine Eyes, generally eight, and sometimes no more than six, two in the Fore-part, two in the Hinder, and the rest in the Sides. They are all without Eyelids, and are covered with an hard, polished, and transparent Crust. As these Eyes are immoveable, they have been multiplied in this Manner, to give them Intimations on all Sides, of whatever relates to them. All these Creatures, in the Fore-part of the Head, have

The Stings. two Stings, or rather Branches, shagged, or indented with strong Points, like a couple of Saws, and ending in a Nail made like the Claw of a Cat. Near the Point of the Nail is a small Aperture, through which, it is evident, they eject a very violent Poison. They have no Arms so formidable to their Enemies as these. They open and extend their two Branches as they have Occasion, and when they no longer make use of the Nails, they bend, and bring each of them down upon its Branch, like a Pruning Knife, clasped upon its Handle. They all likewise have eight Legs, jointed like those of Crabs; and at the Extre-

The Legs. mity of these Legs, three crooked and

The Claws. moveable Claws; that is to say, a small one placed on one Side, like a Spur, by the Assistance of which, they fasten themselves to their Thread; and two others of a larger Size, the internal Part of whose Curve is indented, and which serve them to fix themselves where they please, and enable them to slide either obliquely, or with their Back downwards, by grasping whatever comes in their Way. Even polished Bodies, such as Marble, and Looking-Glasses, have those Inequalities on their Surface, as enable these Creatures to fasten upon them, by the Point of their Claws; but as this Point would be impaired, were they always to rest upon it, in

Their Spon- their Progress from Place to Place, they are
ges. furnished with two little round Balls, or Sponges, on which they advance with a softer

Pace, and draw in their bending Claws, in order to preserve them on those Occasions where they can dispense with their Agency. Besides, these eight Legs,
Spiders

Spiders have two others, inserted into the Fore-part of their Body, and which we may call their Arms, since they do not use them for transferring themselves from one Place to another, but only for holding, and turning their Prey. But with all this formidable Equipage, the Spider would be unsuccessful in her Wars, were she not as well accommodated with Instruments to form an Ambush, as with Weapons for an Attack. She has no Wings to assist her in the Pursuit of her Prey; whereas, her Prey is furnished with them for its Escape, and there would be too much Disproportion in their Circumstances, if the Spider had not a Stock of Thread, as well Their Thread, as a natural Industry to spin it into a Web and Snare, which she spreads in the open Air, through which her Prey is continually passing. Instinct informs her when to set about her Work, and she begins it when her Prey first receives its Birth; and then retiring into Obscurity behind her Net, she patiently awaits the Enemy, to whom she herself is invisible.

I shall now describe the Manner in which she weaves and compleats a Web so advantageous to her Purpose. All Spiders at the Extremity of their Belly, have five Teats, or Papillæ, covered with other of lesser Dimensions, the Orifices of which they open and shut, as well as contract and dilate at Pleasure. Thro' these Orifices they distil that clammy Gum with which their Belly is replenished; and whilst the Spider discharges it thro' one, or more Apertures, the Thread lengthens in proportion to her Distance, from the Place where she first fastened it. When she closes the Openings of her Dugs, the Threads no longer lengthen, and she remains suspended in the Air. She afterwards makes use of this Thread for her Ascent, by grasping it in her Paws, as some People climb up a Rope with their Hands and Knees. With this Thread she spins a Web, that furnishes her with Advantages of a very different Nature. I shall now describe its Texture and Use.

When a House Spider intends to begin a Web, she first chuses a Place that has some Recess, as the Corner of a Chamber, or a Piece of Furniture, into which she may retreat under her Web, and secure herself a Passage either upwards or downwards, and by these Means

The Web
of an House
Spider.

accomplish

accomplish her Escape from any Danger that may occur; she sheds upon the Wall a little Drop of her Gum, which immediately sticks to it. The Spider then lets the Liquor distil through a smaller Orifice. Her Thread lengthens in her Rear, while she proceeds from one Side, as far as the Place to which she designs to extend her Web. The Thread is fastened to one of her Spurs, lest it should fix along the Wall, whilst her Intention is, that it should only traverse the Air. When she is arrived at the Point to which she purposes to continue her Web, from the opposite Side, she there fastens this first Thread by the help of the Glew; and afterwards draws it to her, first bending, and then stretching it tight. Close by this Thread she fixes another, which she carries forward, by running along the first like a Vaulter on his Rope. She proceeds to glew the second Thread, on one Side of the Point where she began her Work. The two first Threads assist her, like a Scaffold, to build all the rest. In this Manner she passes and repasses several Times, connecting or separating her Threads as she judges convenient. I even suspect, by the Expedition with which she proceeds in her Work, that she forms several Threads at once, and in order to keep them separated at an equal Distance, without intermingling with each other, she distributes them into the Teeth of the Comb which I have distinctly seen under each of the large Nails on her Paws. She afterwards stretches and binds these Threads, one after another, with the same Industry. Thus the first Range is hung, and we may call it the Warp.

Chev. I understand you, Sir, she will presently begin to spin her Threads transversely, and that will make the Woof.

Prior. Perfectly just; but the Web of a Spider differs from those we weave, in this Circumstance, that in our Work, the Threads extended in Length are interlaced with those that are carried on transversely; whereas the Threads of a Spider's Woof only cross the Threads of the Warp, and are glewed to them, in the Points where they mutually touch, and are not inserted or interwoven. After this, the Spider doubles and trebles the Threads that bordered her Work, by opening all her Dugs at once, and glewing several Threads one over another. She is sensible that the

Extremity

Extremity of her Web ought to be hemmed and fortified, to preserve it from being torn? She likewise further secures and supports it with strong Loops, or double Threads, which she fixes all around it, and which hinder it from being the Sport of the Winds.

Chev. This is a Work that certainly deserves our Admiration; but I shall still have a real Pleasure to see the Structure of the Lodge where she lyes in Ambuscade.

Prior. The Spider is well acquainted with herself, and conscious that if she made her Appearance she would intimidate her Prey; and therefore, at the Bottom of her Web, she contrives a little Lodge, where she keeps Centry unseen: The two Outlets, one above and the other below, with which it is accommodated, give her an Opportunity of being every where when necessary, and of visiting and cleaning all Parts.

From Time to Time she clears away the Dust, that would otherwise be too incommodious to her Web, and sweeps the whole, by giving it a shake with her Paw; but she considers what she is about, and so nicely proportions the Force of her Blow, that she never breaks any Thing.

From all Parts of the Web are drawn several Threads, that terminate like Rays in the Centre, where she retires and keeps her Watch. The Sound, made by the Vibration of one of these Threads, is communicated to her, and gives her Notice there is Game in her Nets, and accordingly she springs upon it in an Instant. She derives another Advantage from this Retreat under her Web, and that is, the Opportunity it affords her of feasting on her Prey in full Security, besides concealing the Carcasses, and not leaving in the Purlieus, any Traces of her Barbarity capable of intimating the Place of her Resort, and inspiring Insects with an Aversion to approach it.

Chev. I would willingly know, Sir, how Spiders are always supplied with Materials for Spinning; for People torment them exceedingly, and yet we find their Work repaired the next Day.

Prior. That Providence which knows the Spider is hated, that her Labours create her many Enemies, and that her Web is always in danger of being disconcerted, has furnished her with a Magazine for frequent Repairs, and this

this Magazine, after it has been exhausted, is still replenished with fresh Recruits; however, this Reservoir is drained in Time, for when they grow old, both the Gum and Sponges in their Feet are dried up.

Chev. How do they live then in that Condition?

Prior. They use Industry: An old Spider, who has no longer any thing to subsist on, seeks out a young one, and acquaints it with her Necessities and Intention; at which the other, out of Respect to old Age, or Apprehension of the Pincers, resigns its Place to her, and spins itself a new Web in another Situation. But if the old Spider can find none of its Species that will, either by Consent or Compulsion, resign its Nets to her, she must then perish for want of Subsistence.

Countess. The *Prior* has not yet entirely reconciled me to this Animal; but he has however cured me for some Time, of the Aversion I had to hear it so much as mentioned. Nay, I have proceeded farther: for I have observed, as well as I was able, the Work of a Garden Spider, and I find it very different. As her Labour has appeared to me to be very peculiar, I have a mind to give the *Chevalier* some Account of it. There are many People who believe she flies, when they see her pass from Branch to Branch, and even from one Tree to another; but she transports herself in this Manner: She places herself upon the End of a Branch, or some other projecting Body, and there fastens her Thread; after which, with her two hind Feet, she squeezes her Dugs, and presses out one or more Threads of two or three Ells in Length, which she leaves floating in the Air. These Threads are wafted by the Wind from one Side to another, and lodged either on a House or a Pole; sometimes on a Tree or a Stake, cross a Brook, and are there fastened by their natural Glew: She afterwards draws them to her, to try if they are well fixed or not, and then they become a Bridge, over which the Spider passes and repasses in full Liberty. She doubles and extends the Thread as much as she thinks fit, by joining the shortest Slips together, and then marches over a third Part, or to the Middle of the same Thread, and adds another to it, by the Aid of which she descends till she meets with a Stone, a Plant, or some solid Body to rest on,

on, or else she leaves it to fluctuate in the Air, 'till it be fixed to some particular Place. By this second Thread she ascends to the first, and at some Distance begins a third, which she fastens by the same Management. When she has fixed three Threads, she makes them stronger by doubling them; after which she endeavours to project a kind of Square within them, which is easy for her to accomplish, because she ascends by the Thread which joins on the right Hand to that which is extended above, and then she passes to the other which descends on the Left. During all this Progress, she continually spins, and then shortens and bends the Thread which falls on the right Hand, and joins it to that on the Left, in what Part she best approves, and by these means forms a Square, or some Figure that resembles it. In this Square she makes a Cross, with the same Industry, whose middle Point becomes a Centre, to which she draws Threads from every Side, like the Spokes of a Wheel, which all terminate in the Nave. This is the Warp or Basis of the Work. She then spins a finer Thread for the Woof, and first places herself in the Centre, where all the Threads of the Warp meet and cross one another. Round this Centre she projects a small Circle; after which she begins another a little more distant, and always continues to draw this circular Thread from one Spoke to another, 'till she comes to the large Threads which sustain the whole Work. When the Net is thus spread, her next Care is to entrap the Game; for which Purpose she places herself in the Centre of all these Circles, with her Head downwards; because her Belly, which joins to a very slender Neck, would fatigue her too much in any other Position; whereas in this Posture, it is supported by her Feet and Breast. In this Situation she awaits her Prey, of which she is not long destitute, for the Air is so replenished with Flies, who are perpetually in Motion, that a sufficient Quantity of them soon fall into her Toils. When a small Fly becomes her Captive, she dispatches it upon the Spot, because it is a Repast, which does not require much Preparation; but when her Provision is larger, and happens to be a strong Fly who makes a vigorous Resistance, the Spider, wheeling round, involves him in a Number of Threads, with which she entangles, fetters, and then keeps him suspended in the Air; after which she bears him away to the
Nest

Nest below her Web, and which she conceals in the Leaves, or under a Tile, or some other Shelter, commodious either to pass the Night in, or screen herself from the Rain.

Chev. But this Work must be very brittle, Madam, and liable to be carried away by the least Wind.

Countess. The Wind is not so injurious to it as you imagine, for the Web is very penetrable, and the Wind passes through and seldom disorders it; what infests them most is the Rain; but as the Tissue of their Web is very thin and transparent, the Expence is inconsiderable, and they have always Materials for a new Net when they want it. This, Sir, is what I know of Garden Spiders; and I may add, that I lately made these Discoveries after I parted from you: I pursued the Insect through all her Progress, on Purpose to render you a Piece of Service. As to the Spiders that harbour in Vaults, you will excuse me if I can give you no Account of them.

Prior. This Animal contents herself with distributed her Threads about the adjacent Parts of her small Cavern, and forms a little round Avenue in the Centre, to accommodate herself with a free Passage. When an Insect flies about these Territories, it never fails to move one of those Threads which are projected all around, like so many Rays. The Spider, at this Intimation, immediately quits her Ambuscade. She is more malignant than any other Species of these Creatures; if you seize her, by the Assistance of two little Sticks, or in any other Manner, she bites the Instruments that hold her. She is also much better fortified than other Spiders; and the Wasp, for Instance, who, by his Sting and repulsive Armour, so embarrasses the rest, never intimidates her: The Black Spider is not to be penetrated by this Sting; on the contrary, she crushes the Bones and Scales of the Wasp with her Pincers.

I shall bestow but a very few Words on the wandering Spider, and the Long-Legs or Field Spider.

The Wandering Spider. The Wanderers are of several sorts, and various Colours. They generally run and leap; and as they are not stocked with Thread enough, either to entangle their Prey when they want it, or to fetter the Wings of the Flies who incommode them, Nature has fixed in both their fore

fore Paws, which we shall call their Arms, two Tufts of Feathers, with which they stop the Fluttering and Agitation of their Adversaries Wings. There is another Species, not so large as this, of a blacker Complexion, and more singular than the rest; and who, in the Months of *September* and *October*, extend their Threads along the Grass in Meadows, or over the Stubble which remains after the Harvest. She likewise abandons several of these Threads to the Wind, which bears them away. They frequently fill the very Air, and unite, lengthen, and fix on every Place. The Spiders who meet with this Thread fasten themselves to it, and dart, as if they had Wings, to the Tops of Towers and the loftiest Buildings.

Countess. You present us with a true Picture of great Prosperity, for the Attainment of which a Thread must first be found, that may guide to such a Situation. When this is acquired, the Possessor is exalted, but then he hangs by a single Thread. Be pleased now to come to the Field Spider.

Prior. Nothing is more remarkable in this Creature than the extreme Length and Delicacy of its Legs. As she is destined to live amongst the smallest Herbage of the Field, without spinning, the minutest Leaf would stop her, were she unprovided with these extended Legs, that raise her above the common Verdure, and enable her to pursue her Prey with due Expedition.

But it is not sufficient to have given you a Description of the several kinds of Spiders, or at least those who are most common; it will be an additional Satisfaction to you, to know how they range their Eggs, and preserve their Species*. Several People never eat Fruit, because they believe Spiders and other Insects scatter their Eggs upon it at Random; but there is not the least Cause for this Apprehension. They bestow more Preparation and Care on these Eggs than is generally imagined, and are so far from abandoning them to Chance, that they spin, for their Reception, a Web five times stronger than that wherein they catch Flies. 'Tis a Web they work upon with Plea-

The Field Spider.

The Eggs of Spiders.

* *Memoirs de l'Acad. des Sc. M. de Reaumur. 1710.*

sure, and to which they appropriate all the best Materials the Profession can furnish. With this Web they make a Bag, wherein they deposite their Eggs, and it is incredible to think what Care and Labour they employ for the Preservation of that Bag.

Chev. Such a Bag as this makes me laugh heartily; but can't you oblige me with the Sight of it?

Prior. 'Tis good not to be too credulous, and therefore if her Ladyship pleases, we will walk a few Moments by the Box Trees that border this Terras: I have beforehand been searching upon your Account, and have found what you desire to see. Observe in that Box Tree, one of those Spiders who never spin a regular Web, like others. Under her she carries a large white Ball, which you would judge to be Part of her Body.

Chev. And is it not her Belly?

Prior. Nothing less. Take a Twig and shake the Spider a little, to make her drop the Ball.

Chev. 'Tis fallen down and she runs after it.

Prior. This is the Bag of Eggs you was so desirous to see: Don't think the Dam will forsake it: Pray observe her Behaviour.

Chev. I see her roll herself over the Ball.

Prior. She does more, for she forces out of her Dugs a clammy Liquor with which she fastens herself anew to it.

Chev. 'Tis very true; and see how she carries it away.

Prior. She will not stop here; Her Tendernefs for her Young will discover itself by many Sollicitudes. Judge of them by this other Spider, who is of the same Species, and whose Young are hatched.

Chev. Where are they? I only see the Dam.

Prior. Observe what she has on her Back.

Chev. All that I can discover is something prominent.

Prior. Move gently some of the Threads you see scattered here and there in that Opening, and observe what will come out at the Top of the Creature.

Chev. Bless me what a pleasant Sight is here! To my thinking I see above a thousand little Spiders skipping down from their Mother, and running along the Threads: Does she carry her whole Family on her Back? What will become of them now?

Prior.

Prior. Stand still a little: When the Danger is once over, you'll see all the Family come together again.

Chew. And there they are indeed, all assembled in a little Cluster on their Mother's Shoulders.

Prior. Here is a Spider of another Species, who lays up her Eggs in a little Purse like a leathern Cap, which she sometimes fixes on a Wall, and sometimes on a Leaf, as she has done here: She never loses Sight of this precious Deposit; but continues whole Days and Nights near it: She hatches and warms her Eggs, by constantly brooding over them. Pluck off the Leaf, and see what will become of the Dam.

Chew. She suffers herself to be carried away with the Leaf; I am not very fond of such a Neighbour.

Prior. You may kill her sooner than force her to abandon her Brood; She never quits her Hold till the little Spiders are hatched. But tell me, Sir, what see you in that other Opening?

Chew. I perceive two little Bags, or Packets of a reddish Colour, suspended by a couple of Threads; and before these Bags, I see a Pendant of dry Leaves. For what Use are these Things intended? Is not this Work accidentally formed by the Wind?

Prior. 'Tis a Spider of another Kind, who has there hung up those two Bags, wherein she has treasured her Eggs.

Chew. But what may be the Use of this Bunch of dry Leaves, that swings about in the Entrance?

Prior. 'Tis to deceive Passengers, and especially Wasps and Birds, who are upon the Watch for the Bag of Eggs. These little Whisps of dry and reddish Leaves is no proper Morsel for the Birds; and then by its perpetual Agitation, it hinders them from discovering the Packets that are hid behind.

Chew. Prosperity to the Industrious!

Prior. We will not look for any common Spider, to give you an Insight into her particular Qualities; it is sufficient to acquaint you, after what you have seen, that in general all Spiders wrap their Eggs in a Web whose Strength is astonishing. They commonly fasten the Packet to a Wall. When any Danger appears, their first Care is to pull down this Packet, and with it to save themselves
where

where they can. Thus, my dear *Chevalier*, you have my Observations on these Creatures, without entering into a particular Enumeration of all the Species, whose Names, Figure, and Policies, with their manner of weaving, and ensnaring their Prey, are diversified without End.

Countess. We must have a Word or two on the *Tarantula*, for the Species is too extraordinary to be pass'd over in Silence: This Animal very much resembles House Spiders, but the Bite of it, especially in hot Countries, produces very fatal and astonishing Effects. The Poison is not immediately perceptible, because its Quantity is too inconsiderable *; but then it ferments and occasions very frightful Disorders five or six Months afterwards. The Person who has been bitten does nothing but laugh and dance, is all Agitation, and assumes a Gaiety full of Extravagance, or else is seized with a black and dismal Melancholy. At the Return of that Period of the Summer Season when the Bite was given, the Madness is renewed, and the distempered Party constantly talks over the same Inconsistencies, fancies himself a King, or a Shepherd, or whatever you please, and has no regular Train of Reasoning. These unhappy Symptoms are sometimes repeated many Years successively, and at last end in Death. Those who have been in *Italy* † about *Naples*, tell us, this odd Malady is cured by a Remedy still odder; for according to them, nothing but Musick, and especially an agreeable and sprightly Instrument, as a Violin, for Instance, can give Relief; for which Reason they are never without such in this Country. The Musician endeavours to find out a Tone that may seem to bear some Proportion to the Temperament and Disposition of the Patient: He repeats his Attempt, and if he touches a Note which makes an Impression on the distempered Person, the Cure is infallible; The Patient immediately begins to dance, and always rises and falls according to the Modulation of the Air. In this Manner he continues till he has heated himself into a Sweat, which drains off the Venom that torments him, and at last gives him effectual Relief. I had this Account from a Friend of ours, who has been Consul for

* *Memoirs de l'Academ. des Scienc. 1708.*

† *Mysson's Voyage into Italy.*

the *French* Nation at *Naples*, where he assured me, he had seen Instances of People who were bitten and cured in this Manner.

Chev. I find Learning shines through all this Family, and every Thing I hear in this Place is agreeable, and extraordinary.

Countess. You will certainly be surprized, and tell me I am very learned, when I discourse with you about my little Chickens, and all the Wonders of my Poultry, for that Subject will come in its Turn — But I see the Count alighting from his Horse, and he has brought home Abundance of Company. Let us go and receive him.

Chev. I fly to embrace him.

The End of the fourth DIALOGUE.

W A S P S

W A S P S.

DIALOGUE V.

*The PRIOR, and
The CHEVALIER.*

Prior. SIR, the Company who came here Yesterday, have some Affairs to dispatch before they go, and neither the *Count* nor his Lady will be able to wait upon you To-day. As for my Part, I shall make you but indifferent amends for this Loss; but I have a Piece of News to tell you, which perhaps may amuse you.

Chev. What may that be, Sir?

Prior. Something has been just now discovered under Ground, which deserves your Curiosity, the most of any thing in the World.

Chev. Is it to be seen?

Prior. It is, and this very Day too. ——— The Affair, in short, is this. The *Count* desired me to entertain you, this Afternoon, with the Changes that happen to Flies of every Species. I employed, myself, Yesterday, in preparing a full Account for you, of all that can be said on this Subject, and was digesting my Remarks in a little Order, when a Person came to acquaint me, that some Husbandmen, who were at work in our Neighbourhood, had found a Curiosity which had filled Numbers who came to see it, with Admiration. Upon this I immediately left your Metamorphoses, and went, like other People,

to

to take a View of it, and really the Thing deserved it; for they had found an entire City buried in the Earth, and such a City as was capable of lodging between eleven and twelve Thousand Inhabitants. The Structure of this City was perfectly ingenious, tho' very different from ours: The Wall is not a simple Inclosure surrounding the Place, but a great Dome that entirely covers and encompasses it on every Part. After they had carefully surveyed it, they could only discover two Gates; and as the Darkness was very great under this Dome, they had demolished Part of it to have a clear Prospect into the different Quarters of the City. But here another Scene of Astonishment open'd: The Streets are not ranged like ours, in Side Lines, but piled over each other in different Stories, which are separated by several Ranks of Columns; so that they are rather Porticos than Streets; the Uppermost of which rises on the Second, the Second on the Third, and so in Succession, reckoning downwards. The Houses are of equal Dimensions, and thick set against one another in the Substance of the Vault. All the Buildings compose one and the same Order, and are likewise on a Level in each Story, and covered with a flat Terrass, or common Roof, made with a very binding Gum, and as smooth as a Marble Pavement: Here the Inhabitants walk between the Pillars, that support another Vault with its Range of Houses. There are eleven of these Porticos, or Vaults, all of the same Structure, and raised with the nicest Symmetry, and Correctness of Design: 'Tis the Obscurity alone that disfigures the Work; I did not so much as see the Remains of any Lanthorn, or other Contrivance to illuminate the City.

Chev. A very strange Place to live in, surely!

Prior. You believe, Sir, that I am describing to you some City built before the Flood, and which afterwards sunk, and remained buried under Ground.

Chev. I don't know what to think.

Prior. Indeed 'tis a very surprising Affair; for this City was built only by a swarm of Wasps.

Chev. How! Is it no more than that?

Prior. No more than that? — Had this City been even built by Men, there would have been no Occasion to exclaim against it; but it is altogether astonishing, that a

great Dome, with Porticos and Columns; in a Word, that an entire City should be founded by Wasps.

Chev. Let us see this Nest of Wasps then: We shall be diverted with it.

Prior. It is in that Arbour, and I imagined it would be more entertaining to you than a serious Dissertation on Insects. I have preserved it almost entire, for there is only a little Hole made in one of the Sides, to afford a Prospect of what is within. Step in and look at it: You will find the whole City placed on a Bench.

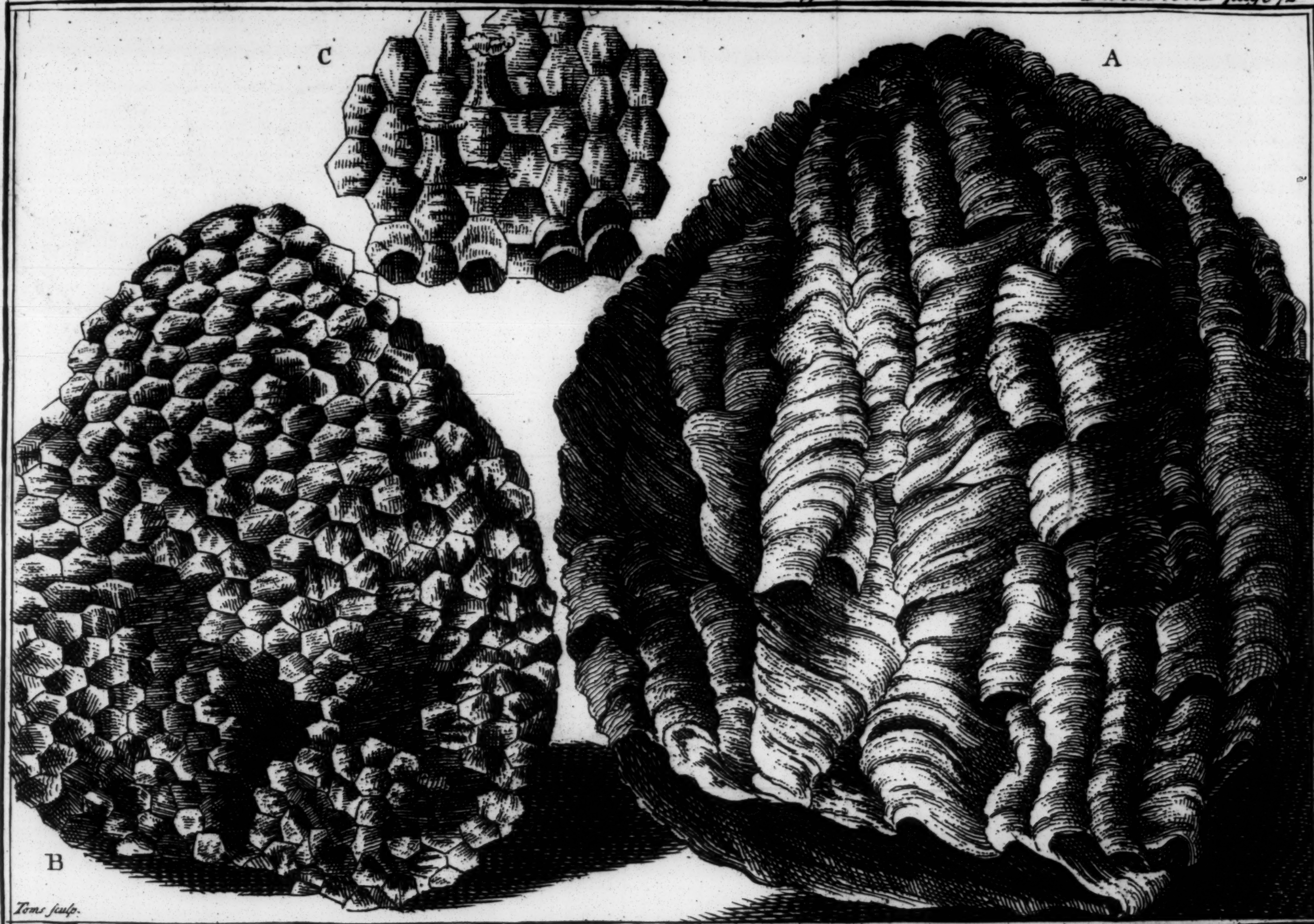
Chev. Oh! Sir, what a delightful Work is here! I see every thing as you have represented. Here are the Pillars, the Stories, Houses, and Cupola. But how could you get this Nest, and where was it found.

Prior. I perceived the Number of my Bees, and my Quantity of Honey sensibly diminished, and suspected that some Wasps Nest in the Neighbourhood, was the Source of this Mischief; and accordingly I ordered it to be destroyed, if it could be found. It was discovered at last, and Yesterday in the Evening they stormed it with Fire and Sulphur. When they had begun to open the Ground at the Wasps Hole, in order to force them out, and burn them in their Passage, I was told they had found a large Pannier, made almost like a Gourd. I knew what it was, and immediately determined to preserve it, that you might have a Sight of it. This is the City then, that I have been describing. But no more of the Terms, City, Colonnades and Architecture: Let us talk of Things simply as they are; there is still enough of the Marvellous to charm you; I speak of the Marvellous unmixed with Falshood; that Marvellous which good Sense demands, and is individually the very Thing you love.

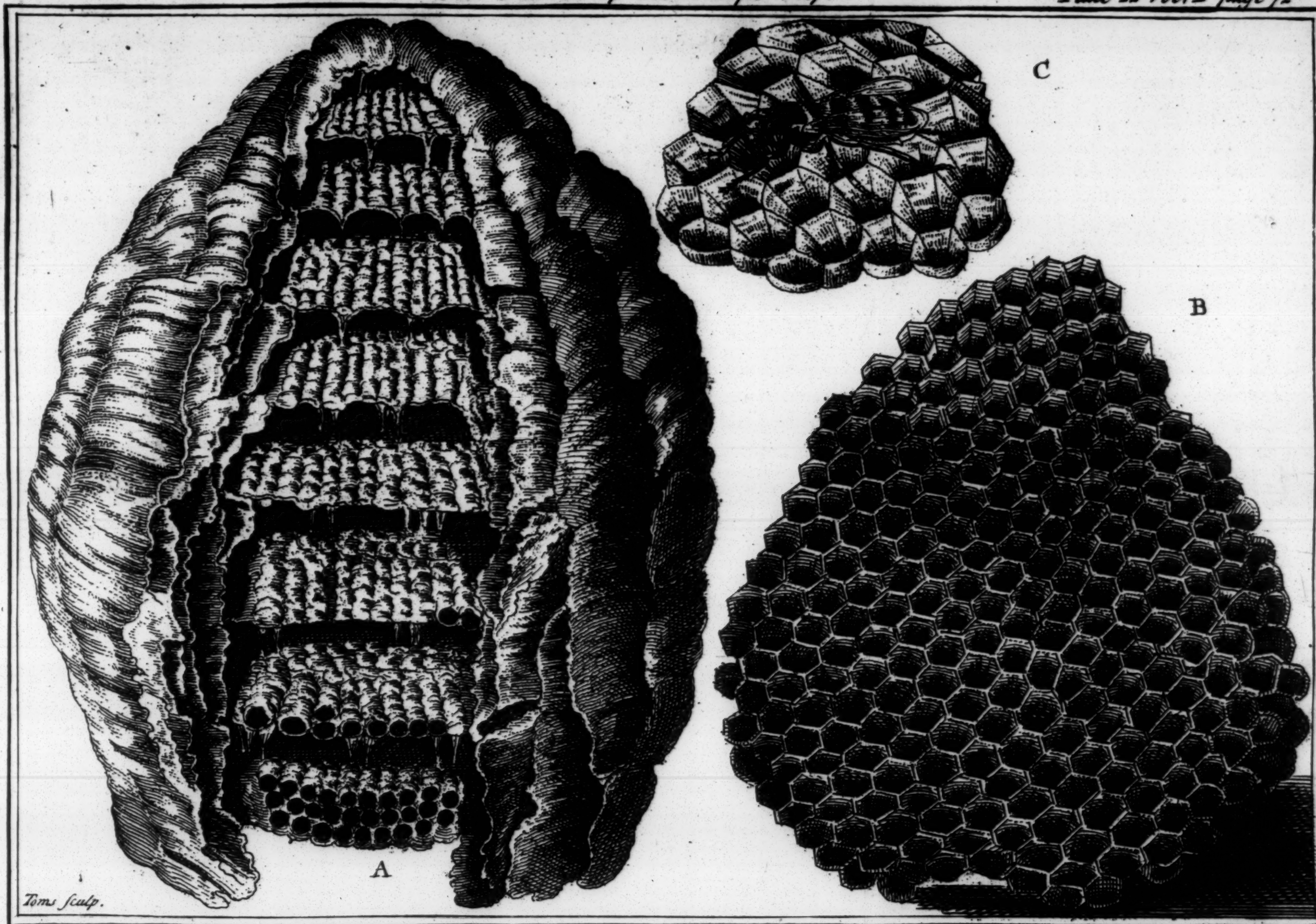
Chev. What is the Original of Wasps, and how do they raise their Building?

Prior. The Wasps who inhabited this Pannier are of three Sorts*: First, the Females who are large, and originally very inconsiderable in Number: Secondly, the Males who are almost as big, but more numerous: Thirdly, the Mules (if I may so express myself) that is to say, Wasps who are consigned to the most laborious Employ-

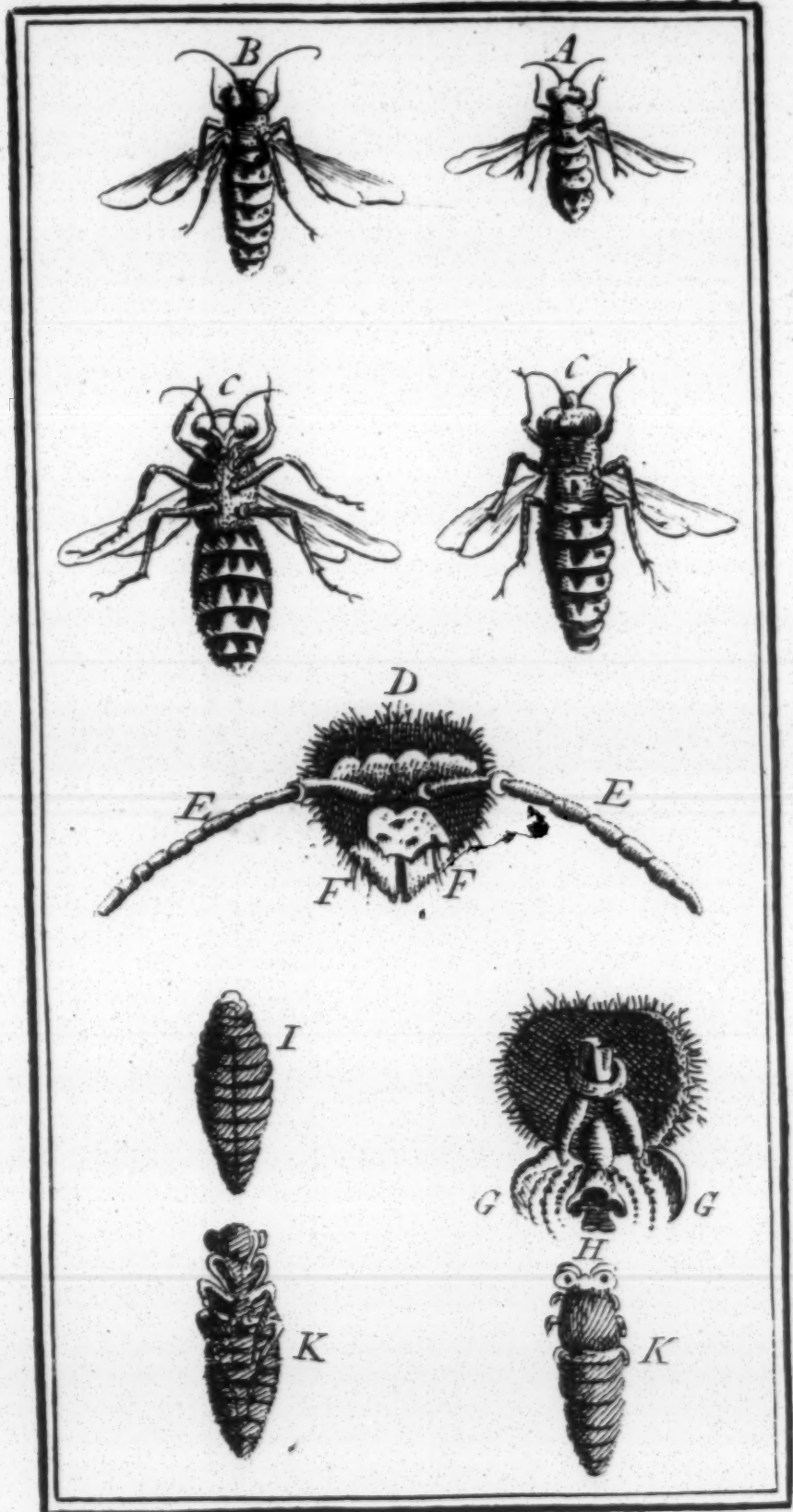
* Memoirs de l'Acad. des Scienc. M. de Reaumur. 1719.



A. The Circumference of a Nest, in the manner it is built by large Wasps, in Timber-Yards, or other places but little frequented. B. the Upper part of one of the Stages. C. Part of a lake or one Range of Cells, where the Top of these is exhibited to view in their natural Dimensions.



A The Nest y^e Fore part of which is broken down, to exhibit y^e inside with its Ranges of Cells & Columns to view. B the inside view of y^e Cells in one Range. C y^e same Cells in their natural Dimensions. Those in y^e four upper Ranges are narrower by a fourth because they are calculated for y^e Reception of y^e Eggs that produce y^e Mule Wasps, who are smaller than y^e Males & Females.



Wasps.

ments, and are neither Males, nor Females: These are much smaller, but vastly numerous, and are the Commonalty of the Nation. There are also three Sorts of Labours wherein the Wasps are employed: First, the building of the Nest; secondly, the providing of Food; and, thirdly, the laying of Eggs, and Nourishment of their Young.

As to the Structure of the Hive, they first chuse about *Midsummer*, a subterranean Cavity begun by Field Mice, or Moles, or else they dig one themselves, and usually on a rising Ground, that the Water may flow down below their Place of Residence, and not be incommodious to them. When they have chosen a Situation, they begin to work with amazing Industry; they scoop out the Earth, and even carry it to a considerable Distance. Their Activity must be very great, since, in the Space of a few Days, they build under Ground, an Habitation above a Foot high, and as much in Breadth. Whilst some are digging, others are in the Fields, seeking Materials for the Edifice. In Proportion to their casting out the Earth, they strengthen the Roof, and prevents its falling in, by cementing it with Glew; they then affix it to the Foundation of their Building, which they continue to finish downwards, as if they would make a Bell, and close it at the Bottom.

Chev. How are they able to remove and throw out the Earth? I can hardly comprehend that Flies should be capable to sink themselves a Dwelling so deep.

Prior. They are provided with excellent Tools for that Purpose: Out of their Mouth a Trunk extends, near which are two little Saws that play against each other to the Right and Left. Besides these, they have two large Horns and six Feet. I don't know whether they employ their Trunk or not, upon this Occasion; but they first, with their Saws, cut the Earth into little Particles, and carry it away with their Paws.

Chev. I have a particular Curiosity to know what Materials compose this Building.

Prior. They are only Wood, and Glew; The Mule Wasps are dispatched to cut the former out of the Frames of Windows,

The Hive.

Their Tools.

The Materials of the Nests.

E

Lattice.

Lattices of Arbours, and Extremities of the Roofs of Houses; they saw and carry off a vast Number of minute Shivers; and when they have hacked them very small, amass little Heaps with their Paws, and pour in a few Drops of a glutinous Liquor, by the Aid of which they knead the whole into a Paste, and then round it into a Ball. At their Return home, they place the Ball upon that Part of the Building, which they would either lengthen, or make thicker: They spread it out with their Trunk and Paws, going backward all the way. When the Ball is reduced to a level Surface, the Wasp returns to his first Stand, where he began to spread the Paste. He then presses and spreads it anew, and always with a retrograde Motion of the Body, 'till he arrives at the opposite Side; and when he has repeated this Operation two or three times, this pliable Composition of Wood and Glue becomes a small Leaf, of a grey Colour, but so exceeding thin, that the finest of our Paper is not at all comparable to it. The Mule Wasp having compleated his Work, on this first Ball, returns to the Fields for more, which he still forms into Leaves, and lays them one over another. Some of his Fellow-Labourers place new ones on the former, and all these Leaves, thus joined and cemented with the same Glue, form the grand Cupola which bends over the whole Habitation. The Cells and Columns are made with the same Materials.

Chew. If I can judge by my Touch, the Columns are extremely hard, and much more so than the Dome.

Prior. Your Observation is just; and it is very certain they are particularly careful to harden those Columns. I don't know whether the Matter be more compact and tenacious, or whether they cement it with a larger Quantity of Glue; but it is very natural, that what sustains the Pile should have the most Solidity.

Chew. Can you acquaint me, Sir, why these little Pillars have larger Dimensions in the two Extremes, where they touch the upper and lower Stories?

Prior. The Materials are spared, with a prudent Frugality, in the Shaft of the Pillar, but it could neither support itself on its Basis, nor sustain its Architrave, without

being well fixed and glewed at the Points of Contact. 'Tis for this Reason the two Extremities were swelled, that they might cover a larger Surface, as it is certain that a greater Circumference of Glew has a more serviceable Effect at the Bottom and Top, I had almost said the Base and Capital.

Chew. There is a great deal of Judgment in all this: But what is the Meaning of these two Openings?

Prior. One is a Passage into the Edifice, and the other leads out of it: through the The Doors. first of these such Wasps enter who are charged with Burdens; those who are going to the Fields, pass out at the other, and, by this Contrivance, they have no Interruption in their Motions.

Chew. I see they have a free Passage under these different Stories, and may enter The Stories. into which Mansion they please. All the Doors of which are open below, except some, that I observe are closed up with a sort of Parchment: But here are several others too, that I find shut up in the same Manner.

Prior. I will acquaint you with the Reason of this in a few Words; but first I desire you to count the Stories, that you see raised one above another, like a Pile of Cakes.

Chew. I count eleven; but this at the Top is very small, and so is that at the Bottom; and they grow larger towards the Middle of the Pannier.

Prior. The most remarkable Circumstance is, that one should see whole Cakes The Cells. composed of spacious Apartments, and others parcelled out into such as are very scanty. The large Cells are appropriated to receive the Eggs, which are to produce Males and Females; the narrow Lodges are to contain the Eggs out of which the Mules, who are by much the smallest, are to proceed. Our Architects are not mistaken in their Proportions, and the Mothers of Families never deposite in a Mule's Lodge, any Egg, impregnated with a Male or Female. The Lodges of the Mules are between seven and eight twelfths of an Inch in length, and about two twelfths of an Inch, or more, in breadth: the Cells of the rest are about eight twelfths of an Inch in

Depth, and something more than three in breadth; the Columns may be six twelfths of an Inch in height.

Chew. I discover thirty nine or forty Columns between one Story and another.

Prior. You will sometimes find more; but at present observe the Regularity of the Cells; they are all Hexagonal, which, in every Respect, is the most commodious Figure for a Range of Cells, where there are no Vacuities; were they round, they would only touch one another in a single Point, and the void Interval would have been quite lost; had they been triangular or square, they might certainly have been very well connected together; but then the Angles within would have been lost, because the Animal, for whose Habitation they were intended, is round. Hexagons approach the nearest to a circular Figure, and have all their Sides exactly adhering to each other, so that there is no useless or unnecessary Vacancy between them, and every Lodge, weak as it is, becomes fixed and solid by its Coincidence with others.

Chew. Believe me, Sir, the finest Palace would not astonish me so much as the Regularity of these minute Apartments: But let us now proceed to the Food of Wasps; for I see you are perfectly acquainted with every Particular in this little Nation.

Prior. I forgive them all the Injuries I ever received from them, and the Honey of which they have robbed me, for the Sake of the Pleasure I have had in studying their Manner of subsisting. They love to lodge themselves in the Neighbourhood of Bees, Vineyards, and the best Garden Vines, and have a particular Fondness for a Kitchen; where they meet with Provisions already prepared. The Mule-Wasps, and even the Males, range the Fields for Prey; they expatiate every where with Intrepidity, and venture into the very Hives of Bees, who are sometimes much embarrassed to defend themselves from their Invasions. When there is no Honey to be found, they fall upon the best Fruits, and are never mistaken in their Choice: The Apricot, for Instance, is very palatable to them; 'tis the same with the Bon-Chretien, and other delicate Pears; the ruddiest Peaches, and the ripest Grapes, especially the Muscadine, are their usual Food, according to the Season; but for all this, they are not over dainty

dainty, for at other Times they can submit to any Diet. Nothing comes amiss to them in a Kitchen; they can take up with Fowl, Bacon, or even Butcher's Meat, and are not so nice as to despise any thing. If they light on the Shambles in their Way, they immediately look to the material Point, and have no Thoughts of proceeding farther: Here they fall to work, and carry off Bits of Flesh, as big as themselves, to their Nest, where the Females distribute their Provision among their little Offspring. The Butchers, who have Discretion enough to understand their own Interest, accommodate the Matter with them, and very hospitably present them with a Piece of Neat's, or Calf's Liver. This they fasten upon preferably to any other Food that has Fibres, which are too long and difficult for them to cut through. But it is not only to divert them from other Meat, that the Butchers compound the Matter with them at this Expence; they derive a great Advantage from this Proceeding, and are not at all dissatisfied with the Visits they receive from the Wasps; for whilst these Creatures are regaling themselves with the Liver, there is no Reason to fear that any Fly, or other Insect, will approach the Place, and make Depredations on the Meat, because the Wasps keep Centry, and chace them without giving any Quarter; and the Fly would be very daring, that should then presume to make its Appearance: The worst that can happen is this; the Wasps may, here and there, mangle some other Provisions at their own Discretion, but the Inconvenience is not very considerable, because this Animal defiles nothing, the Female always confining herself to the Hive with her Eggs; whereas the Fly is very sedulous to lay her own in some Piece of Meat, or other, which is very prejudicial to the Butchers.

Cher. I am extremely pleased with Wasps, and perceive they are very ingenuous Creatures.

Prior. I find their Industry and Neatness make you prejudiced in their Favour, but I must tell you the whole Truth: They destroy all the Merit of these plausible Qualities, by others that are very pernicious. They are exceedingly rapacious and cruel, and, if I may use the Expression, are mere Pirates and Cannibals to the Nation of Bees; not satisfied with stealing Honey, they murder the

very Makers; they seize, they crush, they kill, nay, they even devour their Enemies: This is far from being an amiable Behaviour. But, without excusing them, I may venture to say, that in these Particulars, they resemble great Numbers of our own Species, and even our *Europeans* themselves. The Wasps plunder and devour other Flies. 'Tis the very same with us: How many Men are Wasps in the highest Degree, with respect to their Fellow Creatures? The Difference is, that Wasps are voracious by a natural Instinct that impels them; whereas Man is a Malefactor by Choice, and in Opposition to the Dictates of Reason that enlightens him. We may add, that the Necessity Wasps are under of constantly providing for a numerous Family, in some Measure excuses their Avidity. But to proceed: The Distribution of the Food is made with a great deal of Exactness; the Mothers are charged with this Care, and are sometimes assisted by the Mule-Wasps.

The first Thing discoverable, at the Bottom of each Cell; is a little Egg fasten'd with a viscous Substance, to preserve it from falling. Into this Cell one may see the Dam frequently enter, who apparently communicates a genial Warmth to the Egg in order to facilitate the Birth. From this Egg proceeds a little Worm, which the Parent carefully nourishes, and which by degrees increases in Bulk, and thrives very successfully, filling the whole Apartment with the Roundness of its Form. The Mother after she has received and divided the Provision brought to her by the Mules, goes from Chamber to Chamber, distributing Portions of it with her Mouth to each Worm, in its Turn, and all this with the greatest Equality, except only, that her Supplies are more frequently imparted to the large Worms, who are to produce the Males and Females. Turn up the Hive, Sir, and look into the Entrance of these Cells. — What do you discover there?

Chev. I see the large Worms you mention. Here is one who opens its Mouth, and takes my Finger for its Dam.

Prior. He has been neglected ever since Yesterday, and without doubt, has a pretty good Appetite.

Chev. But a great many of the Cells are stopp'd up.

Prior.

Prior. The Affair is this: All these Worms, after a certain Period, cease to be The Nymphs. burdensome to their Mothers. They leave off eating, and will receive no more Sustainance. 'Tis then they begin to employ their Mouths in spinning a very fine Silk, one end of which they glew to the Opening into their Apartment, and then winding their Head from Side to Side, they fasten it to different Places; and by Virtue of their repeated Motions, form with the Silk, that continually lengthens, a Kind of light Stuff, that serves to close up the Passage. In this Retirement, they divest themselves of their Skin, the Worm dies, her Spoil falls to the Bottom of the Cell, and nothing now remains but a white Nymph, who gradually disengages her Feet and Wings, and insensibly acquires the Form and Complexion of a perfect Wasp. Break some of these Partitions, and you will see her, as it were, swaddled up, and only exhibiting to view, an imperfect Sketch of the delicate Limbs of the succeeding Animal, who gently fortifies himself in the little Mansion which protects him from Danger, till his Feet are all unfolded, and then he breaks through the Partition that shuts him up. I am now going to shew you this: Here, Sir, is a Worm changed into a Nymph.

Chev. What an agreeable Figure it makes with its extended Chin bending back, and the Paws join'd together.

Prior. Some Insects continue whole Years in this State of Nymphs, but the Wasp is not confined to it above twelve, or fifteen Days at most; after which, finding himself equipp'd with all his Furniture, he demolishes the Door of his Cell. You may then see him extend, first one Horn, and then another; to these a Paw succeeds, the Head grows visible next, and the Aperture widens with the Efforts of the Insect's Body, till at last he comes out a compleat Wasp; whose first Employment is to wipe off the Humidity from his little Wings, with his hind Feet, which brush them for some Time; after which, he springs immediately into the Air, and flies to the Fields to pillage with the rest of his Species, whose Address and Malignity he begins to imitate from that Day.

Chev. How! without any Apprenticeship?

Prior. Most certainly. — As for the Mule Wasp, it falls to plundering the Moment it leaves its Retreat. The Male, when he quits his, passes away some Time in sporting, and then goes to make his Court to the Queen of that Quarter. But as soon as ever the Female makes her Appearance, she is busied with the Management of her Family.

Chew. I find the Mother has a very agreeable Time of it in this Country; but I can't help pitying the poor Mules, who are charged with the Weight and Fatigue of all the Work.

Prior. It's true, the Mothers are well treated; they have the best of the Provisions, and are served with the greatest Affiduity and Respect. Nothing can equal the Politeness of their Consorts, and indeed of the whole Tribe. But then the Number of these Mothers is very considerable, and they have a prodigious Family to manage. When you consider the Quantity of Eggs they are to lay, the Multitude of Young they must nourish, the Necessity they are under of perpetually going from Cell to Cell, and from one Story to another, to visit and give Satisfaction to each Individual; to be eternally repeating the same Labour, and, what is worse, to be constantly confined at home; I say, when you consider all this, you will agree, that a Mother-Wasp is in a very indifferent Situation. As for the Mules you are so compassionate to, their Condition is much more eligible; they wing the Air in quest of Food, they pillage, they eat, and sleep without the least Anxiety, and are certainly the Happiest of all the Clan.

Chew. Do the Wasps, Sir, make any Provision for the Winter?

Prior. They don't so much as *take Thought for the Morrow.*

Chew. How are they able then to pass that long and uncomfortable Season?

Prior. At the Approach of Winter every Thing changes in this Republic: When the first Colds begin to be felt, the Females and their Consorts, who till then were so tenderly affected towards their Young, destroy the whole Offspring; Eggs, Worms, Nymphs, complete Wasps, all are

Their Severity.

are involved in the common Desolation; they cast every thing out of the Hive, and leave the very Cells in Ruins.

Chew. What can occasion this Change, and inspire them with so much Fury?

Prior. 'Tis because they are sensible they have no more Time allotted them to bring their Embrios to Perfection, and therefore resolve to charge themselves no longer with an unavailing Care. When the Sun shines, they sometimes take the Air, but Joy and Alacrity ceases among them; they all languish and disperse; they shrink from the Cold, and endeavour to shroud themselves as commodiously as they can. Those who continue in the Hive, pass the Winter there without either having, or seeking any Sustenance. They are either benumbed, or killed by the Frost, and sometimes out of eight or nine Thousand Wasps, or a much greater Number, that inhabited the Hive, only two or three Dams survive.

Chew. How can the Species then be preserved?

Prior. The Mothers are the most vigorous and their Bodies the best adapted to resist the Cold. Could you believe one Female Wasp should be sufficient to produce a whole Swarm the ensuing Year? She builds two or three Cells, that form a Kind of little Cluster, glew'd by the Stalk to the Top of the Cavity, she has either dug or found. There she lays and hatches a couple of Mule Eggs, and seeks for Food to support the Young, The whole Care lyes upon her, as you observe. The two Worms satiate themselves with eating, after which they spin for some Days, and then close up the Entrance into their Cells. You see there are two young Wasps already in Being. The Parent being now discharged from the Care of their Maintenance, forms two other Cells, and whilst each of the new Eggs she has laid are Hatching, and the Young coming afterwards to Maturity, the first Mule Wasps break out of their Confinement, and begin to work with the Mother Insect; and now there are three in Company. Fifteen Days after which, the second Brood adds to the Number; they increase, and begin to enjoy all the Advantages of Society. They accommodate

The Fecundity of Female Wasps.

themselves with a large and commodious Apartment. The little Cluster of Cells is daily augmenting; and then the Mother lays first a Male, and then a Female Egg. You would imagine she did all this by Injunction, since she adjusts the Dimensions of the Lodge to the Size of the Male or Female who is to be born. The Male becomes a Husband, and the Female a Mother. If there are two Mothers in the Month of *June*, there will be fifty within three Weeks afterwards, and these fifty will produce above ten Thousand Wasps before the Month of *October*.

This, Sir, is what I had to observe upon the Article of Wasps. It is not material for me to entertain you with any other Species of these Insects, some of which hang their Nests on the Branches of Trees; and others, who are sometimes twice as large as the common Sort, build their Nest under a Roof, or in a Pile of Timber. The Industry and Prudence of each Species is much the same, and you may form a Judgment of the Works of these last, by what I have related of common Wasps, whose Conduct I have had better Opportunities of observing. But that which, above all, I am never weary of admiring, in all these Species, is the Variety and Justness of the Means, by which Providence arrays, feeds, and defends every Class.

Chev. But you have told me nothing, Sir, of the Sting of a Wasp; Are they not provided with one?

Prior. Not provided with one! — Yes, I am but too sensible of it to my Cost, and have felt it more than once: I assure you I have smarted pretty handsomely, before I could make the Discoveries I have imparted to you; but I would willingly be exposed to greater Hazards, provided they would enable me to teach you any useful Knowledge in an agreeable Manner.

Chev. It is not reasonable that I should have all the Pleasure, and you the Pain.

Prior. Pardon me, Sir, nothing is more consistent. It is but reasonable that Thorns and Stings should fall to the Lot of him who undertakes to teach others, and that Pleasure alone should be the Share of those who are willing to learn.

Chev. I think myself exceedingly happy in such Hands.
And

And now, Sir, shall we make a Transition from Wasps to Bees?

Prior. I shall do it with Pleasure; and, in explaining to you the Structure of a Bees Sting, shall sufficiently describe that of a Wasp, which is the very same. But we must defer this Subject till to morrow, for at present 'tis impossible for me to enter upon it; because I see some People waiting for me. I am really a Servant to my Parishioners, and tho' I have an uncommon Pleasure in your Company, I am yet obliged at present to take my Leave.

The End of the fifth DIALOGUE.

B E E S.

DIALOGUE VI.

The COUNT, *and* COUNTESS.
The PRIOR, *and*
The CHEVALIER.

Countess. **W**E have at last disengaged ourselves, Sir, from the Company who interrupted our Conversations; and the *Prior* has sent to acquaint us, he will be here immediately. In the mean Time, may we know what your Conversation turned upon Yesterday.

Chev. Instead of entertaining me with a long Discourse on the various Conditions and Employments of Wasps, the *Prior* brought me an entire Nest of those Creatures; he shewed me an Inclosure filled with several Ranks of Stories, and a Number of Apartments, some quite open, in which there was only one Egg, or a living Worm, others were closed up, and lodged the Nymphs that were ready to become perfect Wasps. Others had their Doors begun to be broken down, out of which I saw a beautiful Wasp issue, as I was carrying the Nest, the *Prior* presented me with, to my Chamber. I intend to have a Box made on purpose to preserve it.

Count. Take care, however, to expose it, for some Days, in the warmest Sun shine, or even at the Fire, to destroy the Insects that may still be living there. I need not give you a Reason for this Precaution. As to the rest,

rest, I am very glad you have an Idea of the Labours of a Wasp, since it will make you more easily comprehend our Account of Bees.

Chev. I see the *Prior* coming up to our Arbour. What does he carry under his Arm? I fancy you'll find it another Present for me.

Countess. He certainly brings you some new Essay, capable of ocular Demonstration. 'Tis no less than a Honey-Comb.

Chev. That is what I have never seen. It is a happy Thing to have to do with the *Prior*, for one immediately finds every Wish gratified.

Prior. I had no occasion, Sir, to go very far for what I have brought; it was all at my own House.

Count. Let us be seated then: Our Conversation must now turn on a very important Subject; we are going to engage in Politics, and the Government of States.

Prior. Our Discourse must be a little diversified, and set off with an Air of Dignity. I Yesterday entertained the *Chevalier* with nothing but Robberies and Murders, but we will talk to-day of publick Welfare, Colonies, Oeconomy, Policy, and Application to Labour; for all these make up the distinguishing Character of the Nation of Bees. Whatever can be said on the Subject of these Creatures, may be reduced to two Classes; one comprehends the Particulars which are obvious to all the World, and familiar to the Peasants themselves; for which Reason I shall not put the *Count* to the Trouble of giving us a Detail of these. The other contains Points of much greater Curiosity, which cannot be known without the Aid of a Glass Hive, and Philosophic Eyes. His Lordship, who is very well provided with both, will take upon him the Province of instructing us.

Chev. Is it true, Sir, that the Bees have a King?

Prior. You may certainly distinguish three sorts of Bees in a Hive*. The first are the common Species who make up the Populace; are charged with all the Work, and seem to be neither Male nor Female. They are all furnished with a Trunk for their Labours, and a Sting for their

* Memoirs de l'Acad. des Scienc. 1712. M. Maraldi. Leuwenhoek's Arcan. Nat. Tom. iii. Ep. 135.

Defence. The second sort are the Drones, who are of a more dusky Complexion, and bigger than the Bees by one third, tho' some indeed have been found of the same Size with these. The Drones have been thought to be the Males, and beside this, they have no Sting. Above an hundred of this Species have been found in a little Hive of seven or eight thousand Bees *, but the Number is three or four times as great, in a large Hive of seventeen or eighteen thousand. There is likewise a third sort, much more vigorous and long than the Drones themselves, and who are armed with a Sting like the Generality of Bees †. It is thought there is but one of these in each Hive, or at least but one in every Swarm or Colony of young Bees, who, from time to time, are detach'd from the Hive, and go to fix themselves in another Situation. Whether we ought, with the Ancients, to call this large Bee the King; or, with the Moderns, give it the Title of Queen, I leave the *Count* to determine.

Count. By the Assistance of a Glass Hive, I ordered to be made for my Use, I have observed very distinctly, the three Classes of Bees the *Prior* has been describing, and have frequently seen the large Bee, who is dignified with the Title of King, marching from Chamber to Chamber.

The Queen. There was nothing at the Bottom of the Cell, before the Insect sheathed the Extremity of his Body in the Cavity; but when it retired, I observed an Egg left behind: From whence 'tis natural to conclude this Bee to be Female. And as I have often taken Notice, that in a whole Swarm, there was generally but one of this Species, who indeed is very remarkable, tho' there are sometimes two, but never more than three, I thought it more proper to call her the Queen. However, I would not disagree with any one who entertains a different Opinion. But what are the *Prior's* Sentiments about those large Bees they call Drones? They are not Foreigners, because I have seen them born in Cells prepared for their Reception, and which are larger than the others. What then is their Province? Shall we assign them to the Queen as her Consorts? My Hive, has not, as yet,

* Maraldi.

† Leuwenhoek, *Arcan. Nat.* Tom. iii. Ep. 135.

furnished me with Discoveries on that Point, that are altogether satisfactory.

Prior. All that I know, my Lord, of Drones, is this; they have a Bag of Honey in their Bellies, like other Bees; with this Difference, that the Bees have their Bag continued by a little Canal to their Neck, by means of which they discharge the Honey into general Magazines. And when you press a Bee never so lightly, the Honey immediately evacuates thro' this Passage, which is not the Case with the Drone. That Creature eats, and retains all for its own Benefit, and contributes nothing to the common Stock. It lives in Plenty, and never works, or wanders in the Fields; but at the most, only takes the Air, and walks in full Liberty round the Hive: it has no Sting, and the Reason why Nature did not arm it with one is evident: It has no Enemy to fear. As to the rest, I cannot persuade myself, that a Nation so remarkable for Oeconomy, would permit such indolent Companions to dwell among them, unless they were necessary in some Particular. Some have suspected that their Province is to supply the Queen with Issue, or, in other Terms, to people the State with Subjects.

Count. There is something more to be observed: By the Anatomy that has been The Males. made of them, some have thought they have discovered in their Structure, that they were the Authors of Generation. I have endeavoured all I could to observe in my transparent Hive, what Character the Drones maintained with respect to the Queen; and this is all the Discovery I was capable of making. The Queen keeps herself retired in the upper Apartments of the Comb, and which if you please, we will call her Palace. She very seldom appears in public, and whenever she shews herself, you will always see her march with a sedate and majestick Air. You smile, *Chevalier*, but the Matter is quite otherwise. She never walks alone, and if she is not attended by the whole Swarm, she is at least followed by several large Bees, who are probably the Drones that form her Court. As the Sovereign takes her Walk but very rarely, and as these apparently tend to the general Welfare, whenever they happen, a great Festival is celebrated thro' all the Dominions; the whole Nation comes abroad, and every Subject is all Transport; and, in order to give her a solemn Reception

ception, the Bees hang upon one another with their Paws, and, in less than a Moment, form a large Veil, behind which 'tis impossible to discover any thing that passes. This Veil, if you please, shall be a Suit of Tapestry, hung in honour to the Queen's Progress, or else a Curtain drawn by the Domesticks before her —

Prior. Your Lordship ascribes to them very noble, or, at least, very modest Intentions.

Cher. Is not this Ceremony, a Dance occasioned by the Festival?

Countess. A Dance! for my Part I don't know, but am sure it is the last Thing the *Prior* would admit; for he is not very favourable to that Diversion.

Count. As to the rest, whatever may be the Intention of these Creatures, in hanging thus together by their Paws, and forming themselves into a Chorus at the Approach of their Sovereign, the Fact is incontestable; and I have afterwards observed, that the Queen proceeded from Chamber to Chamber, and in each of them deposited an Egg, after she had privately examined whether each Apartment was empty; and whilst she sunk the Extremity of her Body into any Cell, the Drones of her Court ranged themselves in a Circle round her, and turning their Faces to the Queen, fluttered their Wings, and seemed to celebrate the Nativity of this new Progeny. She peoples ten, twelve, and sometimes more Cells at each Fecundation; and is, herself, prolifick enough to give Birth to six or seven thousand Young: In the space of twelve Months, she can see her Children's Children, by the Instrumentality of two or three other Bees like herself, and is, in one Summer, the Ancestor of eighteen thousand Descendants.

Prior. What seems to compleat the Proof that these Drones are so many Stallions, destined only to multiply their Species, is this; they are liberally provided for the whole Summer, but when the Queens have discharged their Swarms, and at the Approach of Autumn, it begins to be foreseen, that there will neither be Time nor Warmth sufficient to rear a new Family, then the Drones are persecuted and expelled; since they are found to be chargeable to the Community, where they only consume the Provisions. The Bees no longer allow them to continue in the Hive. Their Aversion extends even to the young Drones; they eject

eject them from their Cells, and first kill, and then cast them out of the Hive, and after this pursue their Fathers. 'Tis to no Purpose for them to be desirous of staying there; the Bees seize them by the Wings and Shoulders, they juggle and fatigue them, and, without the least Remorse, banish every Individual, except perhaps a very few, and even those of a less rapacious Species, whose Expences are a little more supportable. These are reserved for the Necessities of the ensuing Year; which I the rather remark, because the Queen renews her Pregnancy in the Spring; tho' one sometimes sees among them only those Drones, who, in their Shape and Dimensions, differ very little from common Bees?

Chev. And what becomes of these poor Drones? they give me a great deal of Concern.

Prior. Rains, Birds and Famine are their Destruction, and the Ground near the Hive is covered with their Carcasses.

Countess. I find the Husbands make no very agreeable Figure in this Country.

The Maxim is, that the general Welfare should be the first Law of the State.

Prior. The Bees don't think themselves under any Obligation to support the idle, who, in one Season of the Year, would consume all the Labours of the other, and especially at a time when the Bees themselves can find nothing more to subsist on; and so, *Chevalier*, if the Drones are constrained to be their own Caterers, it is owing not only to Oeconomy, but Necessity itself.

Chev. You are very unwilling, Sir, that one should entertain an ill Opinion of your favourite Bees, and it is evident you are very fond of this Insect.

Prior. I confess they furnish me with a profitable Revenue; and I have known some Years wherein my Bees brought me in more than my Benefice.

Countess. That is not the Reason why they are favoured with your Complaisance; you are warm in espousing their Interest, because they faithfully observe the Moral you inculcate, that those who will not work should not eat.

Prior. That may very well be; but, all Complaisance and Interest apart, 'tis impossible to give even a small Attention to the Manners and Maxims of this little People, without

without finding them perfectly amiable in their Conduct as well as their Industry.

Chev. Their Manners, I confess, charm me, but their Labours deserve a little Consideration, and that is the Point I would willingly come to.

Prior. Before I entertain you upon this Head, it will be necessary to let you see their Implements. The *Count*, who had surveyed them with his Microscopes more accurately than myself, will not be satisfied with any thing I can advance.

Count. I willingly undertake their Description, but don't pretend to give you a compleat Analysis of a Bee's Body; it will be sufficient, my dear *Chevalier*, to take Notice of the principal Parts with which Nature has supplied them, and the Use to which they are devoted.

The Body of a Bee is divided by two Ligaments, into three Parts or Portions, the Head, the Breast and the Belly. The Head is armed with two Jaws, and a Trunk: The former of these play like two Saws, opening and shutting to the Right and Left: These Saws serve them instead of Hands, to hold and knead their Wax, and to throw away whatever incommodes them. The Trunk is a — but I shall do better to imitate the *Prior*, and address myself to your Eyes, since I have an Opportunity of so doing. I have here a couple of these Trunks, glewed upon two Slips of Paper. Look upon them one after another in the Microscope.

The Form
of a Bee.

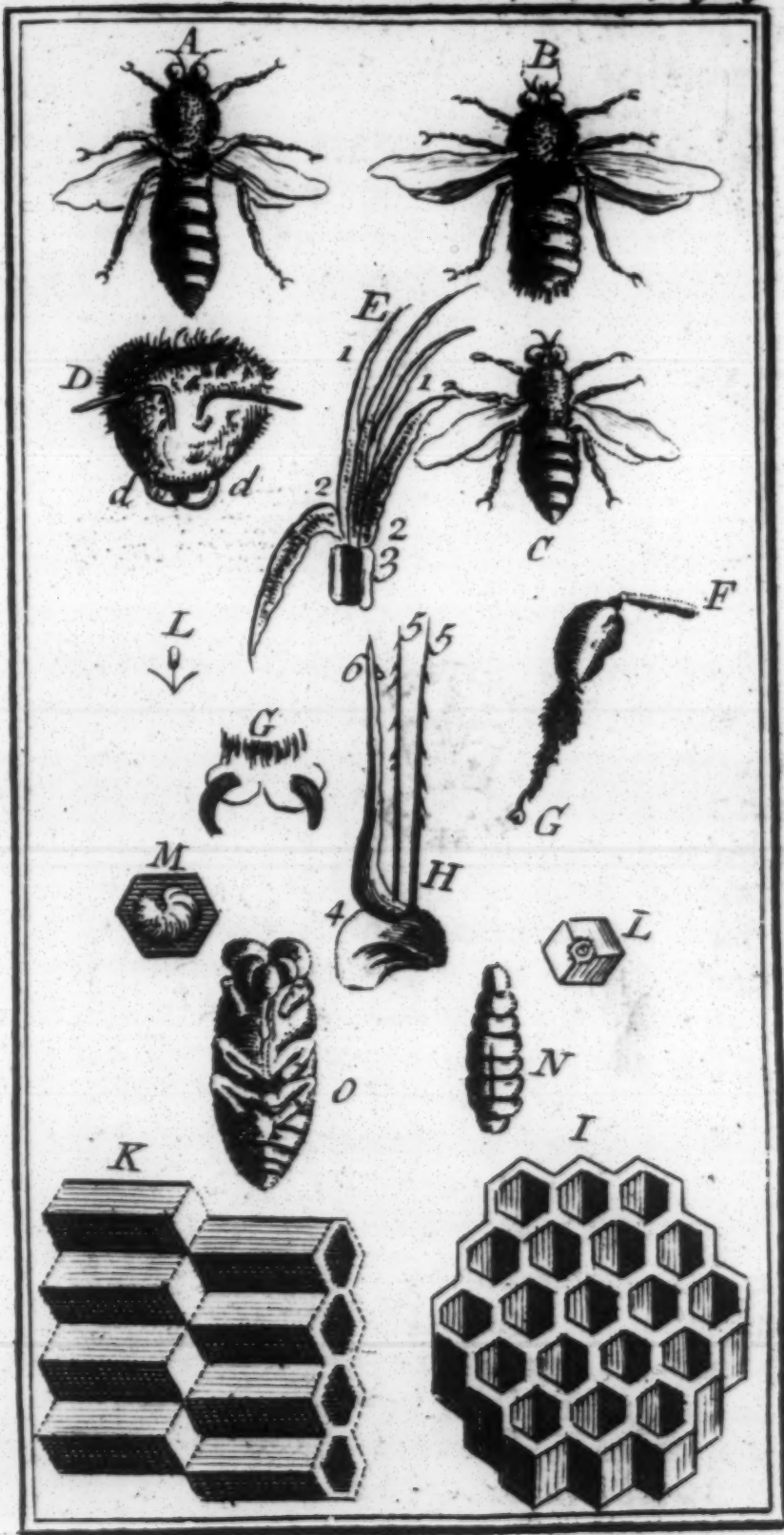
The Jaws.

Prior. They could not be more advantageously placed to make one distinguished by means of the other. Perhaps the *Chevalier* may think these two Figures are the same, or two Trunks that have a perfect Similitude to each other.

Chev. I see one is twice as long as the other; that which is the longest, is thick at one End, and tapers to the other Extremity; it has likewise a small Bending towards the Middle, and at the Bottom, is wound about by four Branches that are hollow within, like a Reed cut into four Parts. I don't comprehend all this.

Count. What you say is, however, very just. Have a little Patience, and observe the other.

Chev.



Bees.



Chew. The other is still thicker, very short, and without the four Branches

Count. Are you sure of that?

Chew. Stay, my Lord, if you please; I think I begin to discover them more exactly: This second Trunk must needs be sheathed, and the Branches perform the Office of a Scabbard. The first Trunk is unfolded for Work, and the second wrapped up in the peaceful Enjoyment of its Acquisitions. This evidently justifies what the *Prior* told me last, That the minutest Things in Nature were appointed to some peculiar End and Purpose; and that the Deity is as conspicuous in the Structure of a Fly's Paw, as he is in the bright Globe of the Sun himself.

Prior. You must habituate yourself to comprehend that this Appointment is certain, even in those Things where it is not understood; because at every Step you will find it, tho' the Reason does not immediately appear; 'tis your Part to enquire after it, and to admire and glorify God in the Discovery. Shew the Trunk of a Bee to whom you please, it may be said, it is but a Fly's Paw; to what Use can it be appropriated? And yet this Instrument is such, that a Bee, with its Assistance, can collect more Honey in one Day, than an hundred Chymists could extract in a hundred Years; and the Wisdom of the Creator, that appears so evidently in the Present he has made of this precious Instrument to the Bee, is not less apparent in the Means with which he has furnished her for its Preservation. For this Trunk is long and taper, as well as pliant and flexible in the utmost degree, that the Insect may be enabled to probe to the Bottom of Flowers, through all Impediments of their Foliage and Chives, and drain them of their treasured Sweets. But were this Trunk always extended, it would prove incommodious, and be liable to be shatter'd by a thousand Accidents: It is therefore composed of two Pieces, connected by a kind of Spring or Joint, in such a Manner, that after the Performance of its necessary Functions, it may be contracted, or rather folded up; and, beside this, it is fortified against all Injuries, by four strong Scales, two of which closely sheath it; and the two others, whose Cavities and Dimensions are larger, encompass the Whole.

Count.

Count. Let us now proceed to the rest of
 The Breast. the Body. The middle Part, or Breast of
 a Bee, sustains the Legs, which are six in
 Number, together with four Wings, two greater and as
 many less; which serve not only to transport her where
 she pleases, but by the Noise they make, to advertise the
 Bees of their Departure and Arrival, and likewise to ani-
 mate them mutually when they are at work. Here is a
 dead Bee, let us take Notice of the Hair which covers her
 whole Body, and assists her to retain the little Grains of
 Wax that fall from the Top of the Chives to the Bottom of
 the Flowers. In the next Place observe, at the Extremity
 of her Paws, two little Hooks, that the Microscope will
 render visible, and exhibit to you in the Form of two
 Sickles rising out of the same Handle, with their Points
 opposite to each other. These hooked Claws, that are so
 serviceable to the Bee in a thousand Instances, are clapped
 over two Balls of Sponge, to render her ordinary March
 more easy and agreeable.

The Belly. The Belly of this Insect is distinguished
 into six Rings, which lengthen, and like-
 wise contract themselves, by sliding over one
 another. The Inside of this Region of the Body consists
 of four Parts, the Intestines, the Bag of Honey, the Bag
 of Poison, and the Sting.

The Office of the Intestines is to digest the Food, in the
 same manner this Function is performed in all other Ani-
 mals. The Bag of Honey is as transparent as Crystal, and
 contains the fluid Sweets extracted from Flowers by the
 Bee, a small Portion of which must remain in the Bag to
 nourish the Animal, but the largest Quantity is discharged
 into the little Cells of the Magazine, to support the whole
 Community in Winter. The Bag of Poison or Gall, hangs
 at the Root of the Sting, through the Cavity of which, as
 thro' a Pipe, the Bee ejects some Drops of this venomous
 Liquor into the Wound, and so renders the Pain more
 excessive.

The Sting. The Sting is composed of three Parts,
 the Sheath and two Darts*. The Sheath
 tapers into a very fine Point, near which is

* Theol. Phys. Derham.

an Opening, calculated to give a free Passage to the Gall. The two Darts are launched through another Aperture, and are planted with small sharp Points, like the Beards of a Hook, and which rising a little obliquely, render the Incision more afflictive, and create the Bee a great of Trouble to draw them out; and indeed she never disengages them, if the wounded Party happens to start, and put her into Confusion; but if one can have Patience to continue calm and unmoved, she brings down these lateral Points, and clinches them round the Shaft of the Dart; by which means she recovers her Weapon, and gives less Pain to the Person stung.

The Scabbard is likewise finely pointed, and makes the first Penetration, which is succeeded by the Injection of the Darts and poisonous Liquor. This Scabbard has very vigorous Muscles, which contribute to its Disengagement from the Wound; but when it has been plunged too deep, these Muscles are torn from the Body of the Bee, and remain with the Sting. The Liquor, which she at the same time infuses into the Wound, causes a Fermentation, attended with a Swelling, which continues several Days; but that may be prevented, by immediately drawing out the Sting, and enlarging the Puncture, to give Perspiration to the venomous Matter. So much for the Implements of Bees.

Let us now proceed to their Labours, and particularly the Structure of their Combs.

Cher. Permit me, my Lord, to ask the *Prior*, what Method they take to assemble all the Bees in one Hive?

Prior. Do but imagine to yourself, a Tribe of these Animals lodged either in the Hollow of a Tree, the Cavity of a Rock, or in a Hive The Hive. they have accidentally found. There they bring up their Young, and when these are come to Maturity, they raise another Progeny. The whole Society dwell peaceably together, as long as their Habitation is sufficiently spacious and convenient; but when the Numbers multiply to such a Degree as renders them incapable of rearing a new Generation, without incommoding themselves, then the old Bees, in whom the Rights and Sovereignty of that Republick are vested, publish an Edict, commanding all of such an Age and under, to seek a new Settlement, and evacuate

cuates the Place at a certain Time, threatening the Disobedient with the utmost Severity of their Stings. I may perhaps be mistaken in the Style of the Proclamation, since I have never seen it; but in Reality, the Refusal to retire at the Time prescribed, draws a bloody War on the young Swarm. However, the Command is generally received with Submission; and on some certain Day, or rather at the same Instant, all the young Nation, with their Queen in the Van, abandon the Hive, and expatiate through the Country, in quest of a new Habitation. This Detachment may be properly called a real Colony. The old Bees always continue in Possession of their ancient Habitation.

Chew. Methinks I am listening to the History of the *Tyrians* and *Sidonians*, who being streightened for want of room, and growing very numerous, dispatched Colonies to *Carthage* and *Cadiz*, as well as many other Places. But I interrupt the History of the Bees.

Prior. When our young Offspring have taken the Wing, they wander with a buzzing Flight thro' the Air, in search of a commodious Retreat, and sometimes fix in a Cluster upon the Trunk of a Tree, and sometimes on a Branch. It may be supposed, that some of them are deputed to the Office of Scouts, and when, in pursuance of their Commission, they have found either a spacious Cavity in a Wall or the Hollow of an old Tree, or else a Hive, which the Country People, who are always vigilant on those Occasions, prepare for their Accommodation, after they have rubbed it over with Balm, Thyme, and other odoriferous Herbs; the Queen, upon the Representation made to her, or in Consequence of her own Observations, puts herself in Motion; upon which the whole Cluster disengage themselves, and follow their Sovereign, who enters into the Cavity presented to her, takes Possession of the Place, and there settles with all her People. 'Tis frequently the Custom to ring a little Bell, or tinkle a Brass Pan, to advertise them that a Mansion is prepared for their Reception. This Sound makes an Impression upon them, and composes their Disorder: And perhaps, they mistake it for a Peal of Thunder, likely to be succeeded by a dangerous Storm. However, in the very Instant either of the Fear, or Tranquility that the Sound inspires, they very attentively

tively consider the offered Retreat. They are not displeased if you oblige them, by some gentle Constraint, to enter into the Hive ; or perhaps, their natural Inclinations may determine them to chuse a Sanctuary there. When this is done, he that presented the Hive to them, removes it very tenderly, and they suffer themselves to be carried off without any Resentment. The Hive is then placed upon a Stand of level Planks, closely riveted together, or upon a Plat of Earth crufted over with a Superficies made of the Dust of Bricks, or Tiles, in order to exclude all Insects and Exhalations. A little Opening is left at the Bottom of the Hive, after which they range themselves in the Manner they are well acquainted with ; what is afterwards transacted, falls more within the *Count's* Province than mine.

Count. When the Labours of Bees are under our Examination, we may consider the Materials they employ in Building, the Use to which that Building is appropriated, and the Manner wherein the whole is transacted. The Materials * are only Glew and Wax, which they collect from various Flowers, the Building is used as a commodious Habitation for themselves and their Offspring ; and as to the Manner of erecting it, let me inform you of some Instances of their Sagacity. I am unacquainted with the Language spoken by the Nation of Bees, but that they have a Language which they understand, and agree to use for the mutual Communication of their Thoughts, is a Fact I take to be undeniable. When they begin to build the Hive, they divide themselves into four Bands ; one of which is consigned to the Fields, to collect Materials for the Structure : The second works upon these Materials, and form them into a rough Sketch of the Dimensions, and Partitions of the Cells. All this is polished and compleated by the third Band, who examine and adjust the Angles, remove the superfluous Wax, and give the Work its necessary Perfection. The fourth Band bring Provisions to the Labourers, who cannot leave their Work ; but no Distribution is made to those whose Charge calls them to the Fields, because it is supposed they will hardly forget themselves ; neither is any Allowance

The Comb.

* M. Maraldi.

made to those who begin the Architecture of the Cells, and indeed their Province is very troublesome, because they are obliged to level and extend, as well as cut and adjust the Wax with their Jaws; but then they soon obtain a Dismission from their Labour, and retire to the Fields to regale themselves with Food, and wear off their Fatigue with a more agreeable Employment. Those who succeed them, draw their Mouth, their Paws, and the Extremity of their Body, several Times over all the Work, and never desist till the whole is polished and completed; and as they frequently need Refreshments, and yet are not permitted to retire, there are Waiters always attending, who serve them with Provisions when they require them.

Chev. Have you seen this, my Lord?

Count. Very perfectly. They express their Meaning by Signs. The Labourer who has an Appetite, bends down his Trunk before the Caterer, to intimate that he has an Inclination to eat; upon which the other opens his Bag of Honey, and pours out a few Drops, which I have distinctly seen rolling thro' the whole Length of his Trunk, that grew sensibly swelled in every Part thro' which the Liquor flowed. When this little Repast is over, the Labourer returns to his Work, and his Body and Paws repeat the same Motion as before.

Chev. Is it very long before the Work is compleated?

Count. Tho' the Elegance and Proportions of it are admirable, yet the Builders are so indefatigable*, that a Honey-Comb composed of a double Range of Cells, backed one against another, and which is a Foot long, and six Inches broad, is finished in one Day, so as to be capable of receiving three Thousand Bees.

Beside this, the Symmetry of these Combs is abundantly more compleat than that of a Wasp's Nest; for the Cells not only terminate at the Bottom in a Point, accommodated to receive the little Egg, and concenter the Warmth which it would not enjoy in the same Degree, were it deposited on a Flat; but they are likewise composed of little triangular Pannels, that regularly unite in a Point, and exactly correspond with the like Extremities of the opposite Cell. Break a few of these little Apartments,

* M. Maraldi.

and you will find the Fact to be as I have described. Take Notice also, that they shape and dispose their Combs in a very different Manner from the Wasps; for whereas these Insects build but one Range of Cells, and place them horizontally over one another, the Bees make their Cells double, or composed of two Ranks of Apartments, the Extremities of which touch each other, and are perpendicularly suspended with an Interval between each two, that affords the Bees a Passage sufficiently spacious, and, at the same Time, contracted enough to promote all the Warmth they can possibly need.

Chev. But, my Lord, I find at the Entrance into all the Lodges a kind of Ledge, which makes the opening at the Door narrower than the Dimensions within; whereas the Passage into the Wasp's Cell is as wide as the Apartment itself.

Count. This is another wise Precaution; for as the Bees live seven or eight Years, and more, and the Wasps seldom survive one, in which Circumstance the Conduct of Providence is very remarkable, and calls for our Gratitude; they fortify the Aperture of their Cells with this Ledge, which, being joined to that of the neighbouring Cells, makes the whole very difficult to be shattered, so that the Work continues several Years uninjured, notwithstanding the Shocks occasioned by the frequent Ingress and Returns, as well as the repeated Efforts of the Mothers who come there to lay their Eggs, and notwithstanding the Motions of the Labourers, who there deposit their Wax and Honey, and the Struggles of the Nymphs, who, when they become Bees, make vigorous Endeavours to disengage themselves from their Confinement.

Prior. These Habitations, *Chevalier*, differ very much from ours, which always decay 'with Time, whereas they grow stronger by Duration, at least to a certain Period.

Chev. How can that be?

Prior. The Foundations of our Houses sink with the Earth they are built on, the Walls begin to stoop by Degrees, they nod with Age, and bend from their Perpendicular; Lodgers damage every thing, and Time is continually introducing some new Decay. On the contrary, the Mansions of Bees grow stronger, the oftener they change their Inhabitants. Every Worm, before its

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Conversion into a Nymph, fastens its Skin to the Partitions of its Cell, but in such a Manner as to make it correspond with the Lines of the Angles, and without the least Prejudice to the Regularity. In one Summer the same Lodging may serve three or four Worms successively, and when that Season returns, it can again accommodate the same Number. Each Worm never fails to fortify the Pannels of his Chamber, by arraying them with his Spoils; and the next Apartment likewise receives the same Augmentation. I have sometimes found seven or eight of these Skins spread over one another, so that all the Cells being incrustated with six or seven of these Coverings, well dried and cemented with a strong Glew, the whole Fabric daily acquires a new Degree of Solidity.

Chev. But I find an Inconvenience in this, Sir; for so many Skins may happen to be glewed over one another, as to render the Apartment too contracted in its Dimensions.

Prior. The Difficulty you start is very reasonable, and I must refer you to the *Count* for a satisfactory Answer.

Count. Can you guess how the Bees proceed in this Case? They alter the Property of these Cells, and lodge their Young where they formerly stored their Honey, and at the same Time deposit their Honey where they once lodged their Young; at least this is the Opinion of some Observers, tho' I shall not undertake to warrant it. As to the rest, you find the Bees are skilful enough in their Works, to induce you to believe they know when it is proper to clear away Superfluities; and it must be confessed, that at the End of six or seven Years, the Cells become too contracted, and all the Work grows ruinous. You have seen, my dear *Chevalier*, their Expertness in Architecture. We must now give you some Insight into their Oeconomy, and direct your Observation to what passes in the Magazines of Wax and Honey: Their Structure and Use will be equally entertaining to you. They have first of all, the Precaution to —

Chev. Ah! my Lord, all is at an End: I see five or six Fox-Hunters, who are now alighting in the Court, and the Servants are going to take their Horses into the Stable.

Countess. We need not break up in a Hurry, those Gentlemen must have their Boots taken off, and Notice will be given us when to wait on them. The *Prior* has
has

has shewn us the Comb, and its Contents; but has not given us a Sight of what is wrapp'd up in that Paper.

Prior. You know, *Chevalier*, the Cells where the Young are lodged; you likewise have seen those which contained the Wax; and I have here, in a Sheet of white Paper, a Piece of the Honey-Comb.

Chev. Must not something be done to the Honey, before it can be fit to eat?

Prior. No, Sir, it is here in all its Purity, and infinitely better than when it has been degenerated by the Hands of Men; pray venture to taste a little, only throw the Wax away.

Chev. I never tasted any thing more delicate, and am no longer surpris'd that the Authors I have read, always mention Honey, when they would acquaint us with something agreeable.

Prior. Honey was the Sugar of the Ancients; but we make very little Use of it now, since we have had our modern Sugar from the *East*, and *West-Indies*.

Countess. In my Opinion, *Chevalier*, you have pretty much of the ancient Palate.

Chev. Madam, I never knew till this Day, what a Honey-Comb was.

Countess. Be wise then in Time. You see the *Prior* is always the same, and gives a perpetual Relish to every thing he does. When he takes his Leave of us, he will go and catechise in some little Hut, where, instead of Honey, he will not fail to distribute his Alms.

Prior. I am very glad my Behaviour pleases your Ladyship; I shall always continue to give Instruction, and even part with as much Honey as will be acceptable. But Charity is your Ladyship's Province, and I am only your Almoner.

Count. These little Animals, whom we behold so sociable in their Community, are industrious to assist each other, and prevent their mutual Necessities with a surprising Generosity; and shall we leave our Fellow-Creatures in Distress! On the contrary, I am convinced, that the finest of all Pleasures consists in preserving Persons from Calamity, and it is a Pleasure capable of increasing in Proportion to our Ability to give. But let us wait on the Company.

B E E S.

DIALOGUE VII.

The COUNT, *and* COUNTESS,
The PRIOR, *and*
The CHEVALIER.

Chev. **G**entlemen, I desire you to remember we are this Day to visit the two great Manufactures of Wax and Honey. The *Prior* has taken a particular View of both, and I should be glad to know first of all, what this Wax is.

Prior. The Bees have two Sorts, one gross and indifferent, the other much finer*. The first is blackish, and pretty much resembles Glew, or a very thick Pitch. The other Kind of Wax is a natural Fat, or a vegetable Oil, finely scented, and thick. This the Bees find around these innumerable little Grains that are visible on the Chives which rise from the Bottom of Flowers, and is a Composition of bitter Juices they extract from certain Plants, Straw, rotten Wood, and impaired, or acid Liquors.

Chev. Wherein is this Glew useful?

Prior. I'll inform you. When they have found a Hive, or some other commodious Habitation, their first Employment is, to close up very exactly, with this Glew, all the Fissures and Crannies, and strengthen the weak Places, so that the Winds can have no Admission; and the Insects, who would otherwise make Depredations on the Glew,

* Maraldi, *ibid.*

are prevented by their insupportable Aversion to the bitter Flavour.

Count. Upon this Occasion I will relate an Event I beheld myself. A few Days since, a Snail took it into his Head to steal into the Glass Hive in my Window. There was no Entrance to pass through but the proper one, and in the Animal went. The Porters received him very rudely at the Gate; and the first Attacks they made upon him with their Stings, obliged him to march with more Expedition; but the stupid Creature, instead of retreating, thought to save himself by going forwards, and he advanced into the very Middle of the Hive; upon which a whole Troop of Bees fastened upon him at once, and he immediately expired under their Strokes. The Conquerors were then in no little Perplexity how to get rid of the Carcass, and a Council was instantly held upon that Occasion.

Chev. And your Lordship, without doubt, understood all their Debates.

Count. From first to last, the most experienc'd Sages among them reasoned in this Manner: To drag the Carcass out by main Strength, is an Impossibility; the Mass is by much too unwieldy, and beside, the Body is fixed to the Floor of the Hive by its own Glew; and to leave it where it lyes, would be very inconvenient, because it would prove an alluring Regale to the common Flies, and at the same Time be liable to Corruption and Worms; and these Worms, when they have devoured the Snail, will infallibly ascend to the Comb, and attack the young Bees. The Damage was evident, and required an immediate Remedy; but you will hardly guess the Dexterity with which they accomplished it. *Chevalier*, I should be glad to know your Sentiments on the Affair. How were they to conduct themselves on this Occasion?

Chev. So quick upon me, my Lord? You are really very severe, to put the Question to me; for it will appear that the Bees had more Presence of Mind than myself. But, pray, how did they proceed?

Count. They incrusted the whole Snail with Glew, and cemented it so close, that all the external Air was excluded; and as no Insect could have Access, to deposit her Eggs in the Carcass, so, when this should be reduced to Cor-

ruption, no malignant Steams would transpire through the Inclosure.

Chev. Will your Lordship let me see the poor Snail's Tomb?

Count. You shall have a Sight of it To-day. It wants nothing but an Epitaph.

Chev. When the Inside of the Hive is well pitched, and the Bees under shelter, how are the Cells disposed?

Prior. The Foundation of the Building is fastened to the Top of the Hive; there they lay a Bed of Grew, to which they fix the first Cells of the Comb, which they continue downwards, and enlarge them till they have no more room left. The Comb is divided into three Cantons; one, where they rear their Young; another, where they store their Wax for their future Occasions; and the third, where they preserve their Honey for the Winter.

I have nothing particular to acquaint you with about their Young, the Circumstances are pretty near the same as they are with the Wasps. When the Worm has left the Egg, the Mother constantly supplies it with Honey; and at the Expiration of ten, or twelve Days, when it has had its Fill, an old Bee comes and closes up the the Cell with Wax. The Worm in its Retirement changes into a Nymph, and the Nymph becomes a Bee; and after fifteen Days repose, the young Bee pierces through the waxen Door, and, when she has dried her Wings, flies among the Flowers, steals their Sweets, and is perfectly acquainted with every necessary Circumstance of her future Conduct.

As to the Structure of the Wax, the *Count's* Observations have been more accurate than mine.

Count. I confess it is a Particular that has very much amused me. The Wax is a Provision altogether as necessary for them, in one Sense, as the Honey itself; they build their Apartments with it, and it closes the Cells of the Nymphs, as well as those where the Honey is treasured. When any Accidents happen, any Fractures open, or when-ever the Species grow too numerous, they recur to the Wax, and therefore are always careful to provide a sufficient Quantity in good Time. They search for it upon all Sorts of Trees and Plants, but especially the Rocket, the single Poppy,

Poppy, and generally all Kinds of Flowers. They amass it with their Hair, with which their whole Body is invested. 'Tis something pleasant to see them roll in the yellow Dust that falls from the Chives to the Bottom of the Flowers, and then return covered with the same Grains; but their best Method of gathering the Wax, especially when it is not very plentiful, is to carry away all the little Particles of it with their Jaws and Fore-feet, to press and work them up into little Pellets, and slide them, one at a Time, with their middle Feet, into a Socket or Cavity, that opens at their hinder Feet. This Cavity is made to receive the Wax, like a Spoon, and the Hair which covers their Feet, serves to keep the Burden fixed, and steady, till they return home. They are sometimes exposed to Inconveniencies in this Work, by the Motion of the Air, and the delicate Texture of the Flowers, that bend under their Feet, and hinder them from packing up their Booty; on which Occasions they fix themselves on some steady Place, where they press the Wax into a Mass, and wind it round their Legs, making frequent Returns to the Flowers; and when they have stocked themselves with a sufficient Quantity, they immediately repair to their Habitation. Two Men, in the Compass of a whole Day, could not amass so much as two little Balls of Wax, and yet they are no more than the common Burden of a single Bee, and the Produce of one Journey. Those who are employed in collecting the Wax from Flowers, are assisted by their Companions, who attend them at the Door of the Hive, ease them of their Load at their Arrival, brush their Feet, and shake out the two Balls of Wax; upon which the others return to the Fields to gather new Treasures, whilst those who disburden'd them, convey their Charge to the Magazine. However, I have seen some Bees, who, when they have brought their Load home, have carried it themselves to a Lodge, and there delivered it, laying hold of one End with their hinder Feet, and with their middle Feet sliding it out of the Cavity that contained it; but this was evidently a Work of Supererogation, which they were not obliged to perform. The Packets of Wax continue a few Moments in the Lodge, till a Set of Officers come, who are charged with a third Commission, which is to knead

Wax with their Feet, and spread it out into different Sheets laid one upon another. This is the unwrought Wax, which is easily distinguished to be the Produce of different Flowers, by the Variety of Colours that appear in each Sheet. When they afterwards come to work it, they knead it over again; they purify, and whiten it, and then reduce it to an uniform Colour. They use this Wax with a wonderful Frugality, for it is easy to observe, that the whole Family is conducted by Prudence, and all their Actions regulated by good Government. Every thing is granted to Necessity, but nothing to Superfluity; not the least Grain of Wax is neglected, and if they waste it, they are frequently obliged to provide more, at those very Times when they want to get their Provision of Honey. When they open the Cells of Honey, they take off the Wax that closed them, and carry it to the Magazine. You may likewise judge of their Oeconomy by another Instance: When a young Bee frees itself from its Prison, by breaking down the Partition of Wax that shut it up, two old Bees immediately present themselves, and carry away all the Remains of this waxen Partition; after which they immediately repair the Ledge of the Cell, and bear all the Wax that is left to the Repository. Thus, you see, nothing is lost.

Countess. But is not this Oeconomy, my Lord, much of a Piece with your Account of the Deliberations about the Snail? I am afraid all the Ingenuity I admire in these Proceedings, flows only from you.

Count. I have sometimes, in a Vein of Pleasantry, supplied them with such kind of Reasonings; but, in Reality, the same Wisdom that created these Animals, has enabled them, for their Preservation, to act as consistently as if they were influenc'd by Reason itself: And as to the Frugality I have been describing, 'tis what you yourself may be a Spectator of when-ever you please.

Cher. Then as to the Honey, my Lord; will you be so good as to tell me what it is, and how they collect it?

Count. The Ancients believed Honey to be an Emanation of Air, a Dew that descended upon the Flowers, as if it had a limited Commission to fall only there. But it has been since discovered that Dews and Rains are very
opposite

opposite to Honey in their Qualities; they wash it away, and prevent the Bees from finding it. Honey is rather an Efflux, or Transpiration of the finest Particles of the Sap in Plants, which evacuate through the Pores, and afterwards condense on the Flowers; and as these Pores are more expanded in the warm Sun-shine than at any other Time, so you never see the Flowers more replenished with a viscous and vermilion Juice, nor the Bees more transported with Ardour and Joy, than when the Sun dispenses his brightest Rays. I likewise take it for granted, that the Season has proved favourable, because excessive Rains either wash away the best Salts from the Soil, or injuriously dilute its purest Juices; as on the other hand, the immoderate Length of a dry Season prevents those Juices from flowing into the Plant.

Chev. Since we know what Honey is, I should think we might go ourselves, and extract it from the Flowers.

Count. Yes; without doubt the Thing is practicable. You only want an Instrument for that Purpose. Go to work, my dear *Chevalier*, and make a Trunk: you remember I shewed you a couple Yesterday.

Chev. I deserve to be rallied for my wise Observation: I should rather indeed have asked your Lordship, whether the Bees content themselves with sucking the Honey from the Flowers, and conveying it home; or is it your Opinion, that the Juices of the Flowers are converted into Honey by the Labours of the Bees?

Prior. For my Part, I am apt to think the Bee makes no Alteration in the Honey, but collects this delicious Syrup as Nature produces it; and first fills her Bag, and then discharges it into the Magazine.

Count. I am of your Opinion in that Particular, and could never observe they were able to condense the Honey, when it was too liquid, as *Virgil* affirms. Perhaps it may be true, that when they receive it into their Body, they purify, and give it some Consistence. But all I have remarked on the Article Honey amounts to no more than this: They suck it up with their Trunk, and empty it into the Cells appropriated to receive it; and when they are all full, the Bees close up some with Wax, 'till they have Occasion for the Honey; the rest they leave open, and

all the Members of the Society resort there, and take their Repast with a very edifying Moderation.

Chev. The Bees certainly act with more Regularity than ourselves.

Prior. The Hive is a School to which Numbers of People ought to be sent; Prudence, Industry, and Benevolence, Publick-spiritedness and Diligence, Oeconomy, Neatness, and Temperance, are all visible among the Bees: Or, rather, let us say, they read us Lectures upon them.

Count. What most affects me, in these little Animals, is to see them actuated by that social Spirit which forms them into a Body Politic, intimately united, and perfectly happy. Look on a Swarm of Bees, and observe the Disposition that influences every Individual. They all labour for the general Advantage; they are all submissive to the Laws and Regulation of the Community; no particular Interest, no Distinction but those which Nature, or the Necessities of their Young have introduced among them. We never see them dissatisfied with their Condition, or inclinable to abandon the Hive in Disgust, to find themselves Slaves or necessitous. On the contrary, they think themselves in perfect Freedom, and perfect Affluence, and such indeed is their real Condition: They are free, because they only depend on the Laws; they are happy, because the Concourse of their several Labours inevitably produces an Abundance that constitutes the Riches of each Individual. Let us compare human Societies with this, and they will appear altogether monstrous. Necessity, Reason, and Philosophy have established them under the commendable Pretence of mutual Aids and Benefits; but a Spirit of Selfishness destroys all; and one half of Mankind, to load themselves with Superfluities, leave the other destitute of common Necessaries.

Prior. As long as Men are not conducted by the Spirit of God, they are certainly the most unjust and corrupt of all Animals.

Count. I cannot express my Indignation, when I see to what Prostitutions our Species degrade themselves, especially when they are possessed with the Fury of Ambition, and determined to live at Ease, without giving themselves the least Pain, to see their Fellow-Creatures barely possessed of Food and Raiment. But let us close this disagreeable Scene, and though we find our Manners condemned by the
Practice

Practice of these little Animals, who associate with so much Tranquillity and Union, yet let us go on to make them the Subject of our Examinations; 'tis an Article that infinitely delights me. I have seen at the Prior's House, a Glass Hive, wherein, as he has told me more than once, he has had a Swarm of wild Bees. Pray, Sir, favour us with some Account of them.

Prior. As I knew your Lordship had made many Observations on the common Wild Bees. Sort of Bees, I thought it would be better for me to bestow some Notice on those who are Wild, in order to observe the Difference. These Creatures, that several People call Drones and Hornets, are nothing near so industrious, and frugal as the domestick Bees. They are more negligent in their Settlements, and their Work is in every Particular inferior to that of the others; but for all this, it has its Beauty. The Nest is composed of dried Leaves mixed with Wax. This Nest, which they usually build in some Cavity dug in the Earth by a Field Mouse, is well vaulted, to preserve it from Rains and the falling in of the Earth. They worked in the same Manner when they were in the Hive, as they would have done in the Field. The Principles of their Architecture are invariable. The Nest is all perforated with different Holes, like a Sponge, so that one may easily see all that passes within. Each Hornet builds with the Wax, a little Cell, about the Size of a large Pea, cut through the Middle, and round and hollow like half an Egg Shell. From these different Cells joined together, results a sort of Cluster very agreeable to the Eye. The Females, whose Number among the Bees and Wasps appears to be very inconsiderable, lay their Eggs in the open Cells; when this is done, some other Bees close them up with Wax; after which they stand upon the Covering, and are in a perpetual Agitation, either to give Warmth to the Eggs, or at least to repel the Cold from them. When the Worms leave the Eggs, they endeavour to break down the Door of their Lodge? The Bees without, assist them in rubbing the Wax, and making it soft, and then comes a large Bee, who devours all the waxen Covering.

Cher. What, does he live upon the Wax?

Prior. No, Sir: but he melts it in his Stomach, which

is very hot, and then employs it elsewhere in some other Work. The Worms who are hatched fall into Convulsions, which moisten them all over with Sweat; and what then transpires through their Body, forms a Glew that gradually hardens, and becomes a little white Skin, which immediately enfolds them. This is their State of Nymphs, and they then look like so many Grains fasten'd to one another, and which, all together, form a little Cluster. After this, out of each Nymph's Shell proceeds a little Bee, who begins to rub his Eyes with his fore Paws. His Wings, that are still spread on his Back, and moist, grow dry in the Air by degrees; and in the Space of a Quarter of an Hour, he springs aloft, and immediately attempts to fly at a Venture with those of his own Age; the young ones are, for some time, permitted to sport as they please, and all the little Bees do nothing, for the three first Days, but flutter up and down, and interrupt the Work of the larger Insects, who at length begin to be weary of these wanton Liberties, in consequence of which they chastise the little Offspring, and bring them down to the Ground; upon which the young ones, after they have turned round a considerable Time, as if they were intoxicated, begin to work in their Turn, and carry Earth to the Nest, to sustain the Sheets of Wax that form the Vault. This Earth they cement and spread out with a backwrad Motion of their Bodies over it. The old ones work in Wax, and the Young only perform the Functions of Masons Servants.

Cher. Have not the wild Bees a King or Queen, as well as the domestick Tribe?

Prior. I have certainly seen amongst mine, and that very frequently, a large Insect, much superior in Size to the rest, and without Wings or Hair; it was as bare as a plucked Fowl, and black as Jet or polished Ebony. This King goes from time to time to survey the Work; he enters into each particular Cell, seems to take their Dimensions, and examine whether the Whole be finished with due Symmetry and Proportion.

Count. I am not certain, Sir, whether you have sufficiently considered this Circumstance, or not, and am very apt to suspect this Monarch to be a Queen, and that her Visits to each Cell, only tend to depofite her Eggs there.

Prior.

Prior. I readily confess my Inaccuracy in this Particular, and your Lordship is much more exact and attentive than myself, in all your Observations. But however, I will proceed in the Account of what I think I have seen, and beg the Favour of you to rectify whatever may lead the *Chevalier* into a Mistake. When this Queen makes her Appearance, all the Bees who present themselves in her Way, form a Circle around her, they clap their Wings, and raise themselves on their fore Feet, and after several Leaps and Curvets, attend her throughout her Progress; at the Conclusion of which the Queen retires, and all the rest return to their Employment. But these wild Insects are far from devoting themselves to Labour, with the same Vigour and Assiduity which the common Bees discover. In the Morning, the Young appear indolent, and are with great Difficulty brought to apply themselves to their several Functions; but in order to rouse them, one of the largest of the Band, every Morning at half an Hour past Seven, extends one half of his Body out of a Cavity contrived for that Purpose, and seated on the most elevated Part of their City; there he claps his Wings for the Space of a Quarter of an Hour, and, with the Noise, awakens all his People. This summons them to work, and is the Drum that beats the Signal of their March. And I have frequently obliged my Fraternity to take Notice of this kind of Discipline, which exceedingly diverted them. There is likewise another, who keeps Guard all Day, and I have seen him acquit himself of his Commission with a Vigilance that astonished me. When I have struck the Hive a little harder than ordinary, the Centinel immediately quitted his Box, and with an Air of great Uneasiness and Emotion, mounted to the Top of the Vault, running here and there, to discover what might occasion the Alarm; when he has satisfied himself that no Danger or Enemy was near, he returned to his former Post. I have sometimes thrown a common Bee into the Hive, after I had plucked off one of his Wings; but he was instantly seized by the Centinel, and laid dead on the Spot.

Chev. This makes the Account I have read in my *Virgil*, of the Guard kept by Bees, very credible. But what, Sir, is the Food of these wild Bees?

Prior. They eat a kind of Honey, but then 'tis inferior
in

in Purity to that of the domestick Bees, because they extract it from Flowers which grow wild, and are impregnated with Juice of a bitter Flavour.

Chew. Do they store up any Provisions?

Prior. Just as the Bees do; and, for that Purpose, they employ the Cells out of which the Worms proceeded: These they fill with Honey, and then close them up carefully with Wax. They are burdened with a Number of Sluggards, and 'tis probably against them that they use this Precaution.

Count. But in what Instance, Sir, did you discover their Idleness?

Prior. In this: When the rest of their Companions have been employed in the Fields, I have observed these roving at a small Distance from the Hive. They give themselves the Air of working a little, and then return home and eat, without having done any thing material.

Count. Your being so much accustomed to see bad Actions in others, makes you suspicious. But these Sluggards, you mention, seem to me to be the Males, as there are such among the Bees; and they are nourished for a Season, in Requit of their past Service; but when Winter comes on, they are probably sent away to provide for themselves elsewhere.

Prior. What your Lordship says, appears very probable; and I see no Reason why the wild Bees should not, as well as the others, have their Queen, their Males, and likewise a whole People without Distinction of Sex. But this is a Point that requires farther Examination.

Count. Let me beg the Favour of you, Sir, to proceed in your Observations on what pass'd in your Hive. All this is new to me.

Prior. Ah, my Lord! my Observations are all at an End, for we met with a very great Accident.

Chew. Pray, what was that?

Prior. Four Days ago, our Queen came out very early in the Morning, and all enfeebled with Age, proceeded with a trembling March to the Confines of her Dominions. I saw her lye down behind a little Eminence; and after she had languished a few Moments —

Chew. What happened?

Prior. She breathed her last, and all the City was in Desola-

Desolation. The Drum did not beat the Signal that Day, and nothing was to be seen but a general Grief and Dejection.

Chev. The Prior makes me sympathise in their Affliction. But what might be the Event?

Prior. It was natural for great Disorders to ensue in the State; the Number of Inhabitants since that time has daily diminished, and they are continually removing in Quest of a new Settlement. The Day before Yesterday, there was a very fierce Battel, and one Animal, more enterprizing than the rest, lost his Head; I saw him run without it to the Top of the Vault, where he did not expire till this very Day. All Order was at an End; the Morning Signal was no more repeated; no Centinel made his Appearance, and the regular Labours were entirely discontinued.

Chev. I am not at all concerned at the Execution of the Malefactor, for I think he makes a very entertaining Figure.

Prior. My Insects are all disconcerted, and I believe very few of them are now left. If the *Count* will trust the *Chevalier* in my Company for an Hour or two, I will shew him the Structure of the Nest.

Count. Do something more, if there are no Stings to be feared; take out the Nest, and send it to me; or rather, let us resign our Pretensions to the *Chevalier*: It will contribute to the Embellishment of his Cabinet, and may be hung up with his Wasps Nest.

Countess. Gentlemen, you have not yet discharged all your Province; we have had a good Account from you of the Industry of Bees; but you have not been particular enough in the Use we make of their Labours, and I must ask the *Prior* how far these are capable of being extended.

Prior. When the Seasons are not irregular, a Hive of Bees may be every Year worth a Pistole and more. If there should be two Swarms, the Profit will be double the next Year, though you should destroy the first Bees with Sulphur, in order to take their Wax and Honey. They are never permitted to work above seven Years, because they grow feeble, and their Labours are exposed to the Ravages of Worms and Moths, who, in Process of Time, find out the Secret of sliding into the Skins with which the young

young Bees hang their Apartments. But I don't take upon me to give you a Detail of the Management of Hives. This is what may be learned from any common Gardiner, and the Country House of honest *Liebaux* is in the Hand of all the World.

Every ore likewise knows the various Uses that are made, not only of Virgin Wax as it comes from the Hive, but of that sort too that has been first washed and then melted, and made white, by exposing it alternately to the Dews and Sun-shine. With this Wax they make not only Flambeaux, Tapers, Images, and a hundred other Things that are well known, but they likewise employ it with great Success in anatomical Representations, that perfectly imitate Nature, and preserve those who have no Occasion to be deeply learned, from the Horror they are apt to be inspired with at the Sight of a Carcass, or Flesh in a State of Putrefaction.

The best
Honey.

The richest Lands don't produce the best Honey; there are some Soils not very luxuriant, that afford Fruits, Fowls, and each Variety of Game, and generally all Productions that have finer Juices, and a more exalted Flavour. And there the Honey is exquisite. Such, for Instance, is the Land about *Corbiere*, a few Leagues from *Narbonne*, and great Part of *Champagne*. The Honey of these Countries is in the best Repute. There is one very peculiar Circumstance observed in the Cantons of *Champagne*, that lye contiguous to the Rivers, and are richer than the rest, which is this: The Bees make long Excursions into the neighbouring Countries, and prefer the Flowers they find in a dry and steril Soil, to those that grow in the very Fields where these Bees were rear'd. A Gentleman who lives near the River *Aine*, and whose Company I enjoy'd one Day, in a Journey from *Chalons* upon the *Marne* to *Charleville*, furnished me with this Observation. We were about a League and an half from his Estate, which lyes in the Valley, on the Edge of the lovely Meadows of *Attigny*; as yet we saw nothing but Heath, and could not discover any Village for above a League in Circumference. Do you take Notice, said he, shewing us a Crop of Buck-Wheat, which refreshed us with a very agreeable Scent; do you take Notice of my Servants who are dispersed about the

the Country, and are all at work for me? But perceiving that we did not comprehend his Meaning; This is the whole Myſtery, continued he, thoſe Bees, who are flying among the Flowers, come hither from a Diſtance of two or three Leagues. We daily ſee them forſake our Gardens, and take their Flight over the Meadows, deſpiſing the Oil and Fertility of our Vallies: In ſhort, they continue their Progreſs to the Mountains and Plains of *Champagne*, where they find Lavender, Thyme, Sweet Marjoram, Buckwheat, and ſeveral other Plants very little cultivated, but of a moſt delicate Sap. You will find Bees all the Way from hence to my Eſtate, and ſome curious Obſervers are perſuaded they have ſeen them, thrice in one Day, take a Journey of a League and an half, or two Leagues, to furniſh their Table to their Palate.

Counteſs. Chevalier, theſe Gentlemen are at the Expence of our Converſations; but as poor as you and I may be, I think, in Point of Honour, we ſhould endeavour to furniſh our Proportion, and bring each of us the Hiſtory of ſome Inſect To-morrow.

Chev. I have made my Court to the *Prior*, who has a Magazine of Curioſities, and purpoſe not to come with empty Hands To-morrow.

The End of the ſeventh DIALOGUE.

FLIES

F L I E S.

DIALOGUE VIII.

The COUNT *and* COUNTESS,
The PRIOR, *and*
The CHEVALIER.

Countess. **P**RAY, Gentlemen, let us know our Riches before-hand, and see what each of us contributes to this Day's Entertainment.

Count. You will have nothing from me but a Fly and a Gnat.

Prior. I intend to give you the Grillotaipa, or Mole Cricket, and the Ant.

Chev. And I the Formicaleo or Lion Pismire, a most terrible Enemy to the Ants.

Countess. Here are Materials enough for one Entertainment, and I may reserve my Part for another Day. When one is not rich, Oeconomy is very convenient.

Count. Let us begin with the common Fly.

The common Fly. As weak and contemptible as this Creature may appear to us, there is scarce any Species of this Insect, but what is furnished with five or six Advantages that are perpetually serviceable to it in all its Necessities. For Instance, it has excellent Eyes, it has likewise Antennæ, or Horns, Wings, Claws, Sponges, and a Trunk.

Its Eyes. Its Eyes, as well as those of Beetles, and Dragon Flies, are of a peculiar Structure: They are two little Crescents, or immoveable Caps, disposed round the Head of the Insect, and comprehending a prodigious Number of minute Eyes,
or

or crystalline Humours, ranged like Lentils, in Lines crossing each other, in the Form of Lattice Work*. Under these one may discover a Set of Fibres, or optick Nerves, corresponding in Number to the external Divisions, or little Planes; and curious Observers will tell you, they have counted several Thousands in each Combination†. But whatever their Numbers may be, it is certain|| that all these Planes are a Collection of Eyes, on which, as on so many Mirrors, outward Objects are painted‡. One may see the Figure of a lighted Taper multiplied almost to Infinity, on their Surfaces, and shifting its Beams into each Eye, in Proportion to its being varied in its Motions by the Observer's Hand.

Chew. To what End is this Prodigality of Eyes bestowed? The Generality of other Animals are well satisfied with two.

Count. The Eyes of other Creatures are multiplied by Motion, if I may use that Expression; whereas those of a Fly are fixed and immoveable, and can only see what lyes directly before them; they are very numerous therefore, and placed on a round Surface, some in a high, others in a low Situation, to inform the Fly of every Thing wherein she can be interested. She has a Number of Enemies, but, with the Aid of these Eyes that surround her Head, she discovers whatever Danger threatens her from above, behind, or on either Side, even when she is in full Pursuit of a Prey directly before her; and the same Object is as distinctly perceived by that Profusion of Eyes, as it is by us, who behold it with no more than a Couple.

When we have finished our Walk, I intend to shew you, in my Microscope, the round Edgings, together with the glazed Substance and Fringe of its Wings. We shall then observe seven or eight Articulations, two bending Claws, and several minute Points, on each of its Paws. Nor shall

The Wings
and Claws.

* *Leuwenboek's Arcan. Nat. Tom. iii. Ep. 111. Nieuwentit. Exist. liv. 2. c. 7.*

† Eight thousand at least, according to *Leuwenboek's* Experim. and Contempl. Ep. 83.

|| *Leuwenboek, ibid.*

‡ *Observations de Puget.*

The Sponges. forget the double Packet of Sponges, placed below, at the Juncture of its Claws. Some Naturalists suppose, that when this Animal marches over any polished Body, on which neither her Claws nor Points can fasten, she sometimes compresses her Sponge, and causes it to evacuate a Fluid, which fixes her in such a Manner as prevents her falling, without diminishing the Facility of her Progress. But it is much more probable that the Sponges correspond with the fleshy Balls, which accompany the Claws of Dogs and Cats; and that they enable the Fly to proceed with a softer Pace, and contribute to the Preservation of its Claws, whose pointed Extremities would be soon impaired without this Prevention. Beside these Sponges, her Paws are shaded with a Growth of Hair, which she employs instead of a Brush to clean her Wings and Eyes.

Chev. I have been sometimes very much delighted to see her perform this Piece of Exercise. She first cleans her Brushes, and then rubs one Paw against the other, and afterwards draws them, first over her Wings, and then under; concluding the Whole with brushing her Head. But what Occasion has she to repeat the same Work so often?

Prior. Cleanliness is her indispensable Care, and she knows, that were it not for this Precaution, Dust and Smoke, as well as Rain and Fogs, would cloud her Eyes, as well as settle on her Wings, and incumber her delicate Body. But we interrupt his Lordship.

The Trunk. *Count.* Her Trunk is composed of two Parts, one of which folds over the other, and both of them are sheathed in her Mouth. The Extremity of this Trunk is sharp like a Knife, to enable her to cut what she eats. She likewise forms it into two Lips, that she may the better take up proper Quantities of Food; and when she sucks up the Air it contains, she employs it, as a Pump, for drawing up Liquors. Several Flies, at the other Extremity of their Body, are furnished with a Piercer *, above three Twelfths of an Inch in Length, with which they penetrate wherever they please, and

* *Leuwenhoek's Arcan. Nat. Tom. iii. Ep. 136. and Tom. ii. Ep. 64.*

then

then sheath it between their Scales. This Instrument consists of several Parts, as particularly one or two Saws finely pointed at the End, and well indented thro' the whole Length; a long Case to enclose them; a System of Muscles, to unsheath them; and a Set of Fibres, to bring them back to their Socket. Its last Piece of Furniture is a Bag of corroding Water, to eat into the Cavities that have been first opened by the Saws.

Those Flies that penetrate the Leaves of the Oak, are furnished with such a Piercer, as I have already described.

Those, whose Punctures are seen in the Bark of * Rose Trees, have one of a very different Structure. It is formed into a long Tube, which terminates in a bending Point, like a pruning Knife, and is accompanied, through its whole Length, with several Ranges of Teeth. The Fly first traces out, with the sharp Part of this Instrument, a small Furrow, on the Branch of a Rose Tree, after which, she places the long indented Tube on that Furrow, and then, by twining and returning the whole Instrument, she opens on all Sides, a Number of Cells, which appear like Ranges of Teeth, disposed in Pairs, along the Extent of a Line that separates them.

The same Tube likewise enables her to depofite an Egg in each Cavity, and when the Heat has at last hatched the little Worm in the Egg, it quits its Mansion, to gnaw a Leaf of the Rose Tree, and gradually increases in Growth, like a small Caterpillar. The Animal, at the End of six Weeks, and after it has frequently changed its Skin, ceases to eat, and descends to the lower Part of the Tree, where it spins a Covering around its Body. The Fly, contained in this Worm, endeavours to force itself a Passage through the Skin of that Creature, and accomplishes her Purpose by Degrees. The Skin of the Worm cleaves open, and shrinks with the Head and Intestines, that are now become useless. The Fluid in which the Fly swims, and which might possibly contribute to its Disengagement from the Worm, begins to dry all around the new Animal, and is then converted into a Kind of Bag or Shell, which makes the Fly seem in a State of Inactivity, and even without any Symp-

* Vallisneri la Mosca de Rosai.

toms of Life. She either continues but a short Space of Time in the State of an Aurelia, or else passes the whole Winter in that Situation, according to the Degree of Heat she then experiences. These few Instances, Sir, will enable you to judge of the Instruments with which each Species is accommodated, and of the various Changes through which they pass.

The common Fly, instead of a Piercer qualified for penetrating Wood, has only a Tube, with which she deposits her Eggs, in Flesh that has been softened by Heat, and likewise in all Substances that are succulent or milky, and salted but little; because the sharp Particles of Salt are more apt to tear the tender Organs of her Young, than contribute to their Preservation. From these Eggs proceed a Brood of Worms, who, afterwards change to Aurelia's, and then to Flies; I omit the Consequences of their extreme Fecundity, and shall only observe, that neither the Lion's Throat, nor the Wolf's Teeth, nor all the Horns and Fangs of wild Beasts, in their united Rage, are so pernicious to Man, as this little Piercer, which Nature has bestowed on a common Fly, to dig a Repository for her Eggs. The Case is not the same with Ichneumon Flies, and several other Species; for they are, in some measure beneficial to us. The Generality of these Creatures sustain and shelter themselves in some particular Plant, and it is to their Solitude to lay their Eggs there, that we owe both the Invention and Materials of the finest Colours, used either in Dying or Painting, as also the deepest Black, common Ink, Scarlet, Vermilion, and many more.

Countess. I have always heard that Ink was a Composition of Vitriol, and Gall-Nuts gathered from Oaks, and that the Scarlet Dye was produced from Cochineal, or Scarlet Grain: And I don't in the least comprehend, what Use can be made either of Ichneumon Flies, or their Piercer.

Count. 'Tis this: There is a Species of Flies * who chuse to deposit their Eggs in the Oak, preferably to any other Tree, and with the Instrument I have been describing, pierce into the Heart of a Leaf, and frequently to the Bud

* Malphigi de Gallis.

itself, whilst it is yet tender, and then with their Saw penetrate to the very Pith. At the same time, she injects into this Cavity, a Drop of her corroding Liquor, and immediately lays an Egg, and sometimes several, there. The Heart of the Bud being wounded in this Manner, the Circulation of the nutritious Juice is interrupted, and by the Mixture of the Poison infused by the Fly, is thrown into a Fermentation that burns the contiguous Parts, and there changes the natural Colour of the Plant. The Juice or Sap, turned from its proper Channel, extravasates and flows round the Egg. After which it swells, and is dilated by the Spring of several little Bubbles of Air, that enter through the Pores of the Bark, and float in the Vessels with the Sap; its Surface is dried by the external Air, and hardens in a Form that resembles the Bending of a Vault, or the Roundness of a Kernel. This little Ball gradually receives its Nourishment, Growth, and Vegetation, like the other Parts of the Tree, and is what we properly call the Gall-Nut.

The Worm that is hatched under this spacious Roof, finds in the tender Substance of the Ball, a Sustenance accommodated to its Nature; it eats and digests it, till its Transformation, first into a Nymph, and then into a Fly: After which, finding itself furnished with all its Equipage, it pierces through the Inclosure, and launches into the open Air.

You may easily be convinced of the Truth of this Account; examine the Gall-Nuts that grow at the Beginning of Summer, and you will immediately see them pierced through; because the Warmth of the Season has advanced the Egg, the Nymph, and the Fly to Maturity. If, when you open them, you should find a little Spider there, don't imagine she came from the Egg of a Fly; for when this Insect quits the Gall-Nut, the Place does not cease to be useful; a small Spider generally slides into the Cavity, and finds a Space already prepared for her Habitation, and there spins her Web, in Proportion to the Dimensions of the Cell, where she ensnares the minute Insects that venture into her Territories.

But the Case is not the same with the Gall-Nut that grows in Autumn. The Cold frequently comes on before the Worm is changed into a Fly, or before the the Fly can disengage itself from its Confinement. The
Nut

Nut falls with the Leaves, and, I suppose, you imagine the inclosed Insect to be destroyed; but the Fact is quite otherwise, and her very Covering contributes to her Preservation. In this manner she passes the Winter, well lodged, and calked up, in the Shell of the Nut, and even buried under a Heap of Leaves that preserve her from all Injury. — But this Mansion, that proves so commodious in the Winter, is a Prison in the Spring; and the Fly, awakened by the first Heats, opens herself a Passage, and expatiates in full Liberty. A small Aperture suffices her, because, at this time, her Bulk is very inconsiderable, and beside this, the Rings which compose the Body, lengthen, and become pliable in her Passage.

Chev. Your Lordship enables me to comprehend the Reason, why we find a Worm under the hard Shell of a Filberd, or a small Nut. It undoubtedly proceeds from an Egg left there by a Fly, when the Fruit was tender, and one always sees the Orifice made by the Piërcer, through which the Insect injected her Egg.

Count. If this Orifice should be closed up, as it is in Fruits, Pease and Beans, it is because the Flow of the Sap into the Wound stops it up by Degrees. The Worm when she forsakes the Egg, finds in the hollow of the Kernel, or the Heart of the Fruit, a Solitude where nothing can incommode her, and has also a Supply of Provisions, in whose Property she has no Competitor. She works there with her Teeth, and Feet, in full Ease, and thrives to Admiration, till finding her Wings unfolded, the Love of Liberty and Pleasure prompts her to make an Opening in the Wall, and then she sallies out to seek Company.

Chev. You make this solitary Act a very pleasant Part.

Countess. This Explication of the Original of a Gall-Nut, frees me from a great Perplexity. I was in Pain to know, whether the Oak which produced the Acorn, did not likewise bear another kind of Fruit of a very different Nature; but I am now convinced, that these Nuts are no more than Excrescencies, occasioned by the Puncture made by an Insect.

Count. They are called Nuts, without any manner of Reason. It is true, they have something like a Kernel, and are gathered from a Tree; but then they have only a false Appearance of a Nut or Fruit, without being either

the one or the other. There is hardly any Plant, but what is pierced in the same manner by some Insect, and which produces some of these pretended Nuts, of all Sizes and Colours. Some Trees have their Leaves entirely crusted with them, but they are not called by any particular Name, because they are never used; but it is possible, that those which grow on the Plane Tree, the Poplar, the Willow, the Box, and Ivy, would afford very rich Colours, were People disposed to make the Experiment.

Countess. Is it not the same with Cochineal, as it is with the Gall-Nut?

Count. Cochineal is neither a Fruit, nor a Gall-Nut, formed by the Puncture made by an Insect; * but it is the Insect itself who pierces the Cochineal Tree. This Plant, which in *New Spain* is called the Nopal, is a Species of the Fig-Tree; the Leaves are thick, full of Juice, and thorny. The Inhabitants who cultivate it, sweep from the Leaves, at the Approach of the rainy Season, several little Insects, that suck the Green Plant. They preserve them in their own Houses, and nourish them with the Branches of the Nopal. When they are grown strong, and the Rains are over, they put twelve or fourteen of them into little Panniers made of Moss, or the Down that covers the Cocoa-Nut. These Panniers they place on the Nopal, and the Cochineal Insects, in a few Days, give Birth to an infinite Number of Young. The Dam lives but a short Time after they have laid their Eggs, and are what may be called the first Produce. The Young forsake the Panniers, and disperse themselves over all the Verdure of the Nopal, and thrive to that Degree, in the Space of three Months, as to be prolific in their Turn. The second Brood are permitted to live, but all the Parents are carried home and killed; the new Off-spring on the Tree have likewise their Young, at the End of three or four Months; but lest they should all be destroyed in the rainy Season, the Inhabitants carry home the Dams, as well as their Off-spring; and this is the third Produce. A sufficient Number of the young Insects are preserved, to continue the Species the next Year, and all the rest are killed in hot

* Hist Nat. de la Cochenille verifiée par les attestations des Juges de la Province d'Oxaca, Amst. 1729.

Water, or Ovens, or upon flat Stoves, on which the *American* Women bake their Bread. The Insects, * that are destroyed in hot Water, are of a brown Colour, inclining a little to red; those who are killed in the Oven, are of an Ash Complexion, and streaked like Marble, and such of them as expire on the Stove, are black, and seem burnt. Their Inside is filled with a beautiful red Dust. These Insects are sent to us dried, and half reduced to a Powder, in which, without the Assistance of a Microscope, one may distinguish an oval Body, Scales and Paws, or little Pieces of them bruised, and a small pointed Trunk.

The Lack, which produces the finest Red, is a resinous Gum, gathered by Flies, or winged Pismires from different Flowers, † and this they depofite, either on the Branches of a Tree, or on Poles, which are presented to them by the Country People, with an Intention to profit by their Labours.

The Drain of Kermes, or Scarlet, is a little red Shell, formed by the Insect that pierces the Green Oak, or small Holm-Tree; and when the gathering of their Shells has been too long neglected, a particular Species of Flies make small Punctures in them, and slide in their Eggs, which produce Worms and Flies; but these are not to be confounded with the little Vermin that live with their young, in the Cavity of this Shell. Other Tribes of Flies and Insects, are likewise at Work upon all our Plants. We indeed are not curious enough to make any Experiments on what they offer us, and perhaps take long Voyages to the *Indies*, for Commodities that are daily presented to us at Home.

Chev. We are charmed, my Lord, with your Flies; but are the Gnats too as curious in their Kind?

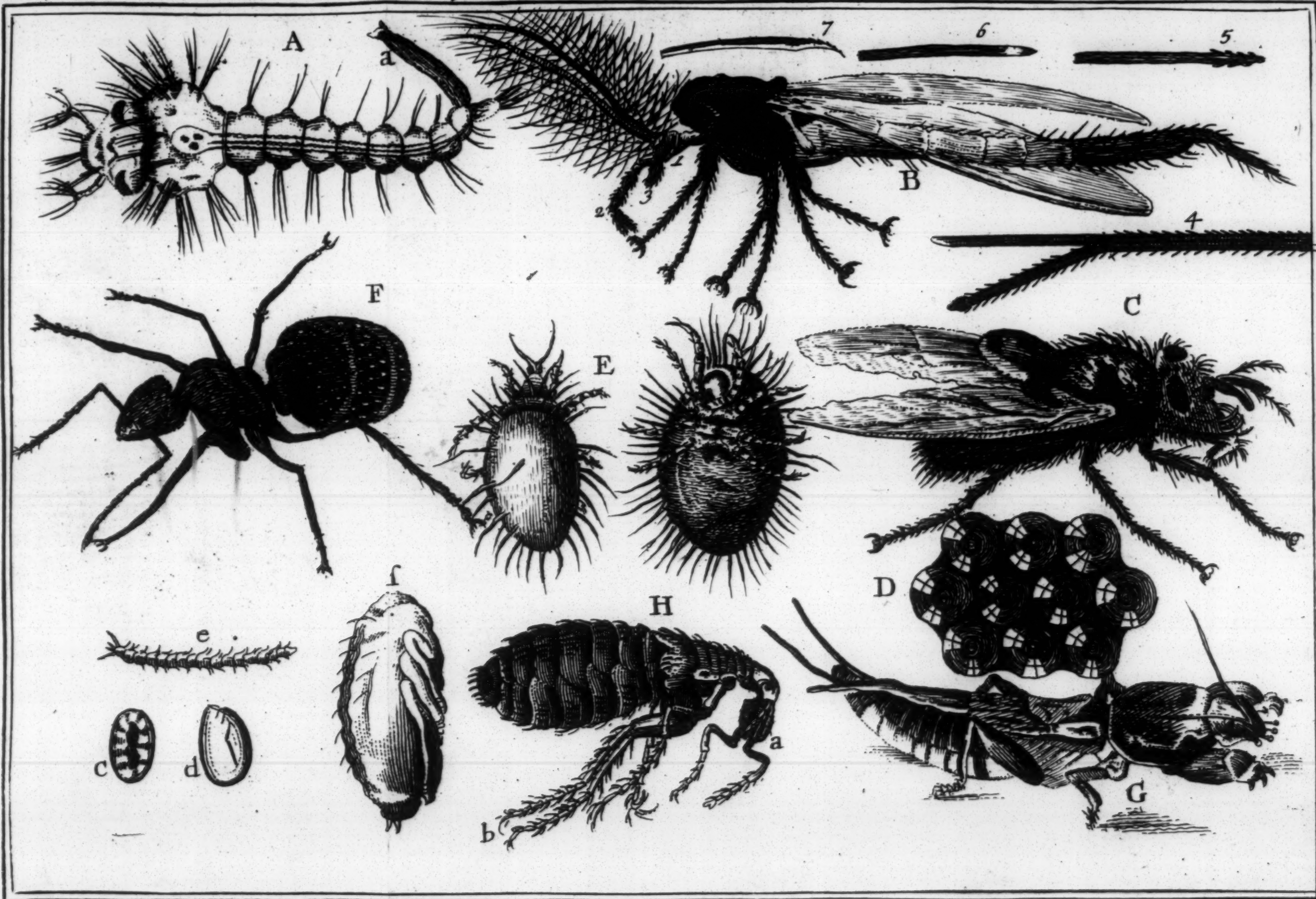
Count. Their Usefulness perhaps is not so great, but their Transformations are more extraordinary. Let us take a Turn along the Mote of the Castle. I have discovered what we want. Stoop down a little, *Chevalier*, towards the Root of that Tree which shoots into the Water. What do you discover on the Surface of the Mote, close by the Root?

* Harwoek Essai de Diopt. p. 52. Paris 1694.

† Memoirs de l'Acad. des Scienc. M. Geoffroi, le Jeune, 1714.

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Chew. I see something like a little Sieve, fasten'd at one End to the Stump of the Root.

Count. That Sieve is a small Piece of Glew, sustained by the Water, and the pretended Holes of the Sieve, are Eggs properly ranged upon the Glew, * to prevent them from sinking; and the Fastening which joins it to the Root preserves the Whole from being carried away by the Winds, to any other Situation that might prove too cold, and where the Eggs, for want of Sun-shine, could not be hatched.

Chew. What Animal has taken all these wise Precautions?

Count. 'Tis the Work of Gnats, who are so well known by their Buzzing, and sharp Stings.

Chew. How! does the Gnat, who lives upon the Earth, and in the Air, lay her Eggs in the Water?

Count. Have you not frequently seen Gnats flickering along the Surface of standing Waters? They are fond of that Neighbourhood, because there they rear their beloved Family. I grant there are other Species, that seem to be born in the deep Recesses of Woods, and probably at a great Distance from the Water; but I will give you the History of those that have come to my Knowledge, in a few Words.

From the Eggs strewed over a Bed of Glew, on the Edge of the Water, proceeds a Brood of little Animals who pass through three different States. They are first Inhabitants of that fluid Element; they then change from aquatick to amphibious Creatures, living both in the Air and Water; and at last confine themselves entirely to the Air.

In their first State they are Aquaticks, in which Period they wear the Form of minute Worms, and make themselves little Lodgments of Glew, which they fasten to some solid Body, at the very Bottom of the Water, unless they meet with any Chalk; which, being more pliant and soft, permits them to sink a Habitation in its Entrails, where they are defended from the Teeth of Fishes, but not from the Claws of Cray-fish.

Their three States.

* Hist. des Ins. par Swamm.

This Worm, in Process of Time, is divested of its Form, and acquires a large Head, and a Tail shagged with Hair, and moisten'd with an oily Fluid, that, like a Cork, assists her to sustain and transport herself from Place to Place, her Head sometimes raised in the Air, and sometimes plunged in the Water, and her Tail sliding on the Surface. If the Oil, with which her Tail is lubricated, begins to dry up, she discharges an unctuous Humour out of her Mouth, and sheds it over her Tail; this restores it to its Faculty of steering her where she pleases, without being moistened, or prejudiced by the Water.

The Gnat, in her second State, is properly in the Form of a Nymph, which transfers her to a very different Condition of Life: She immediately disrobes herself of her second Skin, resigns her Eyes, Horns, and Tail; but, from the Ruins of the amphibious Animal, a little winged Insect springs into the Air, with a Body actuated by a surprising Agility, and constituted with the finest Texture of Limbs, the Head is beautified with a delicate Plumage, and all the Body invested with Scales and Hair, to defend it from Humidity and Dust. She tries the Activity of her Wings, by rubbing them against her Body, or two Bags which hang at her Sides, to poise her in an equal Motion. The Furbelow of little Plumes that border those Wings, are admirable in their Kind.

The Trunk. But nothing is more precious in the Equipage of a Gnat than her Trunk, and one may venture to say, this feeble Instrument is one of the greatest Wonders of Nature; it is so extremely minute, that the best Microscopes hardly give us a View of its Extremity †. What is first discoverable, is a Case composed of long Scales, that she carries under her Throat, and which, at about the Distance of two thirds of its Extent, has an Opening thro' which she launches four Darts, and then returns them into their Quiver: One of these Darts, as pointed and active as it is, performs the Office of a new Case to the other three, which are there sheathed in a long Groove, and have their Sides sharpened like fine Swords; they are likewise barbed, or thick set, with cutting Teeth, towards the Point, which is a little

† Leuwenhoek, Arcan. Nat. Exper. & Con. Ep. 69.

hooked, and whose Fineness is inexpressible. When all these Stings are darted into the Flesh of Animals, and make their Wounds sometimes one after another, and sometimes in Conjunction, the Blood and Humours of the adjoining Parts must unavoidably be forced out of their Vessels, and cause a Tumour in the Incision, whose little Orifice is closed by the Compression of the external Air.

When the Gnat, by the Extremity of her Sheath, that serves her instead of a Tongue, has found out any Fruits, Flesh, or Juices she has been seeking; if it happen to be a Liquor, she sucks it up without ejecting her Lancets; but if she meets with Flesh that resists her Efforts, she stings very severely, and then sheaths her Weapons in the Scabbard, which she applies to the Orifice of the Wound, and, through the Cavity draws up the Juices she finds there.

This is the Instrument with which the Gnat is accommodated for Summer Work; but, in the Winter Season, she is released from the Care of obtaining Provisions; for then she ceases to eat, and passes all that melancholy Season in Caves and Quarries; which, at the Return of Summer, she forsakes, and takes her Flight in Quest of a standing Water, where she may have an Opportunity to perpetuate her Family, who would soon be hurried away by the Rapidity of a running Stream. The little Progeny are sometimes so numerous, that the very Water is coloured, according to the Complexion of the Species. When they are green, it exhibits the same Tincture; as it deepens into a sanguine Dye, when the Insects happen to be red. 'Tis now the *Prior's* Turn to favour us with an Account of the *Grillotalpa*.

Countess. The Sound of that hard Word shocks my Ear, why don't you give it the Air of our Language? Is not this the Animal I have seen in your Closet, stretch'd on a green Turf, and covered with a little chrystal Vase. The Creature is near three Inches long, has two Horns before, and as many behind, to give it Intelligence of all that passes amidst the Darkness in which she resides: She has likewise a Couple of strong, short Wings, and two that are very long; a large Coat of Mail on her Back, and two Arms fortified with a couple of dreadful Saws.

The Form of
the *Grillotalpa*.

Count. 'Tis the very same.

Countess. I think I have heard it called a Mole-Cricket; because it lives under Ground, like a Mole, and imitates the Chirping of a Cricket; and this is the Name I would chuse to give it.

Prior. The Ladies have a greater Privilege than our Sex, in the Use of new Words, and her Ladyship's Authority may give a Currency to this Term; we will therefore trust to the Event.

Count. With the *Prior's* Leave we will walk to a Corner of the Parterre, where you will find a Nest of these Mole-Crickets. You see I have Intelligence of all that passes here. Each Tribe of Animals is at work for me. This is the Place.

Prior. Let us take a Spade, and shew the
 The Nest of *Chevalier* a Clod of cemented Earth, in the
 Eggs. Heart of which he will find * a little Apartment capable of containing two Filberds, and there all the Eggs are lodged. Let us open it gently, and be careful we don't break any Thing. That, Sir, is the Clod I was speaking of, you see it appears as large as an Egg, and is surrounded with a little Trench. Take it up and cut it through the middle. You will find the Entrance into the Chamber has been closed up.

Chev. 'Tis very true. What a prodigious Number of Eggs are lodged in the Cavity! Let me count them. I find an hundred and fifty. But why are they laid there?

Prior. Were the Eggs covered with less Caution, or should the least Breath of Air be admitted to them, they would be destitute of the necessary Warmth, and the whole Posterity would be destroyed. Beside this, the Mole Crickets are obliged to stop up, with so much Exactness, the Mouth of [the Cell where they lay their Eggs, and to sink a Trench all around it, because there is a little black Animal, a mortal Enemy to their Species, who opens himself a Passage under Ground, and endeavours to devour their Eggs and Young; to prevent which, one of the Tribe perpetually keeps Centry on the Bank of the Trench, and when the black Animal plunges himself in to seek his Prey, he is immediately cut short, and the Nest,

by this Precaution, is delivered from its Invader. If the Centinel finds himself assaulted by too many Enemies, he then throws himself into these winding Paths, you see struck out under Ground, and so evades the Danger. But I am now coming to the most singular Piece of Dexterity we have observed in the Conduct of these Animals, and which we discovered by the Assistance of a Glass Bell, under which we reared some of these Creatures, in a Quantity of Earth sufficient to furnish us with our Observations.

At the Approach of Winter, the Mole Crickets remove the Reservoir which contained their Eggs, and sink it very deep in the Earth, always taking care to dig it lower than the Frost can penetrate. When the mild Season comes on, they raise the Magazine, in Proportion to the Advances of that favourable Period, and at last elevate it as near the Surface, as will be sufficient to make it susceptible of the Impressions of Air and Sun-shine: And should the Frost return, they again let it down to its proper Depth. The same Method is practised by the Ants, whose History I am now to give you; for I am Ants. not sufficiently acquainted with Mole-Crickets, to entertain you any longer on that Subject. But before I begin, I would ask the *Chevalier*, whether we are to visit the Ants, in the Quality of indolent Persons, for Instruction, or, in the Capacity of Connoisseurs, for Admiration?

Chev. I understand you perfectly well, Sir, and have been informed by the *Proverbs* of *Solomon* *, that the Idle ought to go to the Ants, to learn how to be provident. Perhaps I am no Sluggard; but yet where is the Person who has no Occasion to be taught a prudent Forecast?

Prior. The Sight of Ants is really very instructive. They are a little People united, like the Bees, in a Republick govern'd by its own Laws and Politics †. They have a Kind of oblong City, divided into various Streets, that terminate at different Magazines ‡. Some of the Ants consolidate the Earth, and prevent its falling in, by a Surface of Glew with which they incrust it. Those whom we commonly see, amass several Splinters of Wood, which

* Prov. vi. 6.

† Aldrovand. de Formicis. Johnston, Thaumaturg. Nat. p. 356.

‡ History of the Buccaneers; towards the End.

they draw over the Tops of their Streets, and use them as Rafters to sustain the Roof; and across these, they lay another Rank of Splinters, and cover them with a Heap of dry Rushes, Grass, and Straw, which they raise with a double Slope, to turn the Current of the Water from their
 Their Streets. Magazines; some of which are appropriated to receive their Provisions, and, in the others they deposite their Eggs, and the Worms that proceed from them.

As to their Provisions, they take up with every Thing eatable, and are indefatigable in bringing home their Supplies. You may see one loaded with the Kernel of some Fruit, another bends under the Weight of a dead Gnat. Sometimes several of them are at work on the Carcass of a May-Fly, or some other Insect. What can't be remov'd they eat on the Spot, and carry home all that is capable of being preserved. The whole Society is not permitted to make Excursions at random. Some are detached as Scouts, to get Intelligence, and according to the Tidings they bring all the Community are upon the March, either to attack a ripe Pear, a Cake of Sugar, or a Jar of Sweetmeats; and in order to come to this Jar, they leave the Garden, and ascend the House; there they find this Mine of Sugar, this rich *Peru* of Sweets, that opens all its Treasures to their View; but their March to it, as well as their Return from it, is under some Regulation. The whole Band is ordered to assemble, and move in the same Track, but the Injunction is not executed with much Severity, and they have Liberty to expatiate, when they have an Opportunity to spring any Game in the Country. The green Vermin, that make an infinite Waste among the Flowers, and cockle the Leaves of the Peach and Pear Trees, are surrounded with a Glew, or Kind of Honey, which is sought for by the Ants with great Avidity; but they are not solicitous either for the Flesh of these Creatures, or for any Part of the Plant. These are the Vermin who are the Authors of all that Destruction to our Trees, which is falsely imputed to the Ants, and draws upon them a very unjust and cruel Persecution.

Their next prevailing Passion is, to amass a Store of Corn, or other Grain that will keep; and lest the Humidity of the
 Cells

Cells should make the Corn shoot up, we are told, for a Certainty, that they gnaw off the Buds which grow at the Point of the Grain.

I have seen Ants carry, and sometimes push before them, Grains of Barley and Wheat, much larger than themselves; but I never could find out their Granary. All the Ancients mention it, and *Aldrovandus* assures us he had seen it. Their Labours, as well as their Inclinations, may vary according to their Species. 'Tis likewise probable that their Aurelia's, which are sometimes yellow, have been taken for Grains of Corn without Buds, and swelled by Moisture.

The Ants, after they have passed the Summer in a constant Employment and Fatigue, shut themselves up in the Winter, and enjoy the Fruits of their Labours in Peace; however, it is very probable, they eat but little in that Season, and are either benumbed, or buried in Sleep, like a Multitude of other Insects. And therefore their Industry in storing up Provisions, is not so much intended to guard against the Winter, as to provide, during the Harvest, a necessary Sustenance for their Young. They nourish them as soon as they leave the Egg, with an Assiduity that employs the whole Nation; and the Care of their little Progeny, is esteemed a Matter of Importance to all the State.

When the Young quit the Egg, they are little Worms, no longer than common Grains of Sand*, and after they have, for some time received their Aliment, which is brought to them in common, and distributed in equal Proportions, they spin a Thread, and wrap themselves up in a white Web, and sometimes in one that is yellow; at which Period they cease to eat, and become Aurelia's. In this State, some People fancy they are the Eggs of Ants, when, in Reality, they are the Nymphs, out of whose Ruins the new Pismires are to rise. Though the Young discontinue their eating, their Nurture still proves very fatiguing to their Parents. These have generally several Apartments, and remove their Young, from the Nursery, to some other Mansion which they intend to people. They either raise the Aurelia's toward the Surface of the Earth, or sink them

* *Leuwenhoek's Arcan. Nat. Tom. i. & iii. Ep. iii.*

to a distance from it, in Proportion as the Season is either warm or cold, rainy or dry *. They raise them when the Weather proves serene, or when a long Drought is succeeded by gentle Dews; but, at the Approach of Night and Cold, or the Appearance of Showers, they clasp their beloved Charge in their Arms, and descend with them to such a Depth; that one must then dig above a Foot into the Earth, before those Aurelia's can be discovered †.

We might enlarge on many other Particulars of their Conduct, such as their dispersing themselves over the Country, their Custom of removing the Dead from their Habitations, their Promptitude in assisting each other to carry their Burdens, or invade their Enemies. A long Description might likewise be given of the small Sting they carry in the Extremity of their Bodies, with a Bag of corroding Water that causes little Tumours. Much might be also said of their Wings, that are acquired by the Males, at a certain Age, to facilitate their Acquisition of Food, and which are refused to the Females, ** that they may be more sedentary, and better devoted to domestic Cares; but the Subject the *Chevalier* has chosen for our Entertainment is so extremely agreeable, that it would be an Injury to the Company, to deprive them any longer of so much Pleasure.

Chev. After the History of the Ant, the most natural Transition is to that of the Formicaleo, so called, because it is the Lion, or most formidable Enemy to the Ant.

Countess. Rather call it the Lion Pismire. We are Masters of the Terms, at least in our Academy.

Chev. That Name is perfectly agreeable, and I shall never call this Creature by any other. I yesterday saw a pretty Picture of one of them, in the *Prior's* Apartment, that represented all the Changes thro' which the Creature passes. I am tolerably well acquainted with the whole Train of Particulars †, but, that I might not fatigue the Company with frequent Hesitations, and lest I should for-

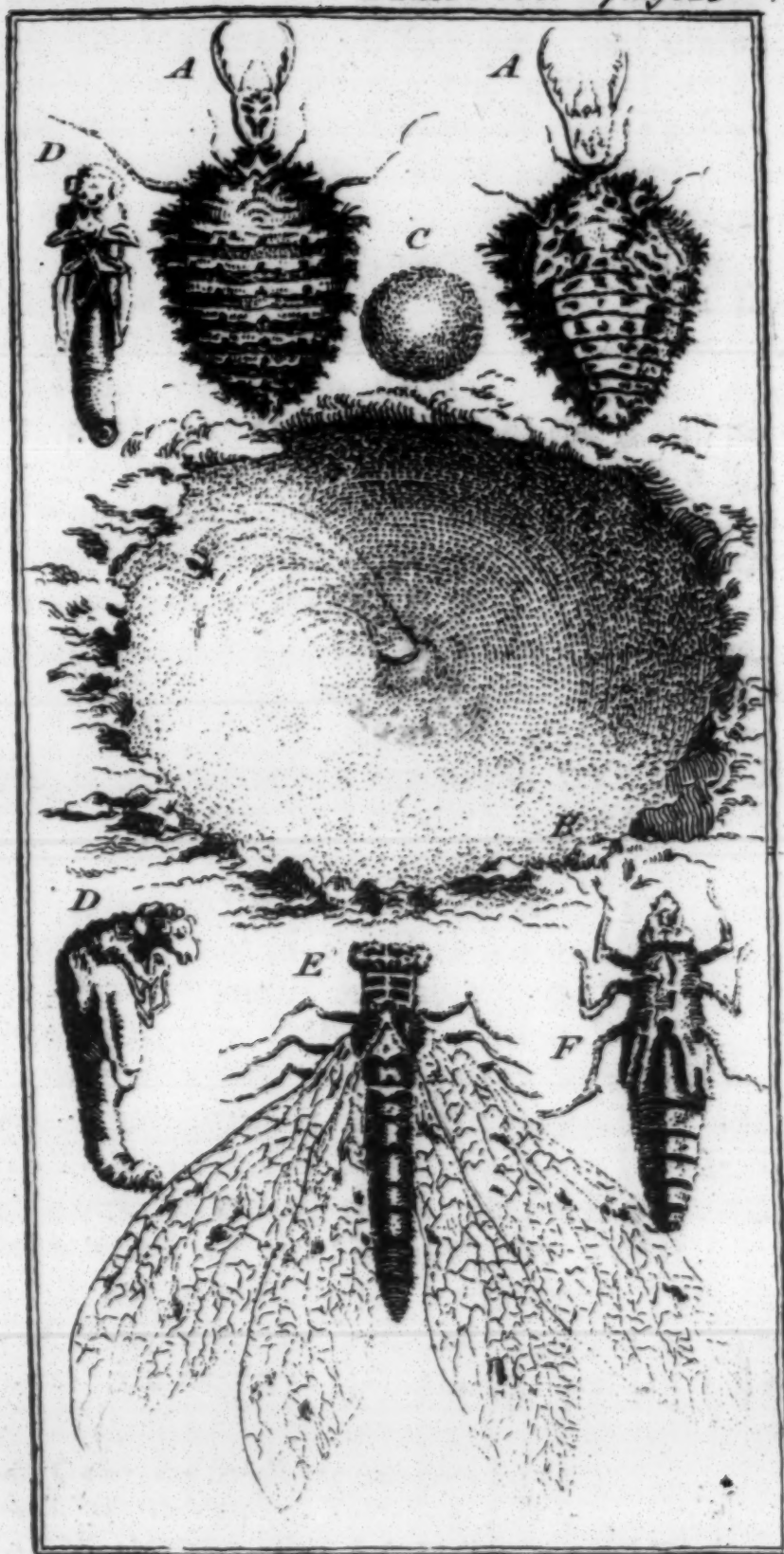
* Hist. Gener. des Insect par Swamm. p. 162.

† Lowthorp's Abridgment, Tom. ii. p. 7. & 9.

** I think, however, that I have observed the whole Tribe of an Ant-hill furnished with Wings, and forsaking their subterraneous Abode.

‡ M. Aubriet dessinat. au Jardin Royal.





L. Motte jé.

The Lyon Pismire

get any necessary Circumstance, I have committed the whole to Writing, and this Morning communicated it to the *Prior*, who has touch'd it up with his own Hand; which I desire may be remembered.

Countess. The Gentleman delivers himself in such a natural Air, as is worthy to introduce the most entertaining History.

Chew. The Lion Pismire is as long as the common Palmer *, but something thicker; it has a very long Head, and the Body grows round as it lengthens towards the Tail. The Animal is of a dark Grey, marked with black Spots. Its Body is composed of several flat Rings, that slide over one another. It has six Feet, four of which are inserted in the Breast, and two in the Neck. Its Head is small and flat, and from the fore Part of it, two little Horns shoot out: These are smooth and hard, extend two Twelfths of an Inch in Length, and bend like Hooks in the Extremity. Towards the Base of these Horns, appear two small Eyes, very black and lively, and which are extreamly serviceable to the Creature, for he starts from the smallest Objects he discovers. Other Animals are furnished with Wings, or Feet at least, to make them expeditious in the Pursuit of their Prey; but this is only capable of marching backwards. He never follows his Prey, and would sooner dye than advance a Step towards it. The Prey must come to him, and he is gifted with the Secret of making it fall into the Ambuscade he has prepared. This is the only Method he has for his Subsistence, and is all the Science he is Master of; but however it suffices for his Purpose.

Lion Pismires.

Their Shape.

Instruments.

He chuses for himself a Bed of dry Sand, at the Foot of a Wall, or under some Shelter, that the Rain may not disconcert his Work. He is obliged to make use of Sand, and of the dryest he can get, because a solid Soil, as well as a moist Sand, would not prove tractable under his Operations. When he intends to hollow the Trench where he ensnares his Game, he bends the hinder Part of his Body, which

The Trench.

* Memoirs de l'Academ. des Scienc. Monsieur Poutpart, 1704.

rapers into a Point, and then plunges it, like a Plough-share, into the Sand, which he throws up in his Rear, with a backward Motion of his Body; and thus, by repeating his Efforts, and taking several Rounds, he at last traces out a circular Furrow, whose Diameter always equals the Depth to which he intends to sink it. Near the Edge of the first Furrow, he opens a second, and then a third, and several others, which are smaller than the preceding, and sinks himself from time to time, deeper in the Sand, which he throws aside with his Horns, on the Edges of the Furrows, and to a much greater Distance, always marching backward in a spiral Line. The repeating Strokes of his Head, whirl the Sand out of the Circle, and gradually scoop out a Cavity, in which Operation he exceeds the best Engineers; He describes a perfect Circle, and draws out a Volute, without the Assistance of a pair of Compasses. He likewise gives the Slope of Earth which he hollows, all possible Solidity. In this dexterous and indefatigable Manner he compleats his Trench, which resembles a Cone reversed, or rather the inside of a Funnel.

When this Creature is newly hatched, he opens a very small Furrow, but when he increases in Bulk, he digs one more spacious, the Cavity of which may contain two Inches or more in Diameter, and as many in Depth. When the Work is compleated, he forms his Ambuscade, and conceals himself under the Sand, in such a Manner, that his Horns exactly wind round the Point in which the Bottom of the Funnel terminates. In this Situation, he watches for his Prey, and woe to the Ant, the Palmer, or any other Insect who is so indiscreet as to play round the Edge of this Precipice, which descends in a Slope, and that too in the Sand, to give a Downfal to the little Animals who are too incautious in their Approaches. 'Tis for the female Ant that the Lion-Pismire thus adjusts his Kitchen. She is not aided with Wings, like the Generality of Insects, to disengage herself from this Cavern, but then she is not the only Prey, for other Animals are also destroyed by the Dexterity of this Hunter. When he knows by the fall of some Grains of Sand, that a Prize is near, he shrinks back and moves the Sand which immediately rolls to the Bottom with the Prey. If this Prey has Agility enough to be capable
of

of remounting in an Instant, and, with this Advantage, is likewise assisted with Wings, the Lion-Pismire whirls a Quantity of Sand into the Air, above the Height of the flying Animal. This is a dreadful Shower of Stones, to such a tender Creature as a Gnat, or an Ant. The unfortunate Insect, blinded and overwhelmed in this Manner, by the Tempest that pours down from every Quarter, and hurried away by the Instability of the Sand that rolls from under her Feet, falls between the Saws of her Enemy, who plunges them into her Body, drags her under the Sand, and then feasts upon the Victim. And when nothing is left, but the Carcass drained of all its Juices, he is particularly careful to remove it out of Sight. The Appearance of a dead Body would deprive him of future Visits, and bring his Place of Residence under a bad Reputation: he therefore extends his Horns, and with a sudden Spring, tosses the Slain half a Foot beyond the Trench; and if this should happen to be disconcerted and filled up, by such an Expedition, or if the Aperture becomes too large for the Depth, and the Declivity loses its proper Slant, he repairs the whole with all Speed; he rounds, he deepens, he clears the Cavity, and then watches for a new Prey.

A Hunter's Profession, they say, generally requires Patience, and the Lion-Pismire **His Patience.** has as large a Share of this Quality, as he has of Craft. He sometimes passes whole Weeks and Months, without Motion, and, what is most surprising, without Food itself.

His Abstinence, which is very serviceable to him, is so extraordinary, that I have known him live above six Months in a Box exactly closed up, and where he had no other Accommodation than Sand. I have seen them complete their Work as usual, and then change into Nymphs like others, whom I have carefully nourished. 'Tis true, those who eat, improve both in Growth and Vigour.

When he has attained a certain Age, and would undergo a State of Renovation, in order to appear in his last Form, he then troubles himself no more with his Trench, but begins to work in the Sand, where he strikes out a Multitude of irregular Tracks, and certainly engages in this Labour, in order to warm himself into a Sweat; after which he plunges into the Sand, and the viscous Humidity

midity which flows from every Part of his Body, fixes and unites all the Grains he touches. With these sandy Particles, and the dried Glew that consolidates them, he forms a Crust which encompasses his whole Body, like a little Ball of five or six Twelfths of an Inch in Diameter, in which the Animal reserves himself a competent Space for Motion. He is not satisfied with a bare Wall, which would inevitably chill him, but spins out of his own Bowels, a Thread, which, in fineness, infinitely surpasses that of the Silkworm, which we have so much admired. This Thread he fastens, first to one Place, and then extends it to a second, still crossing and interlacing it. By these means he hangs all his Apartment with a Sattin tinged with the Colour of Pearls, and perfectly beautiful and delicate. In this Work all the Propriety and Convenience is confined to the Inside, for nothing appears without but a little Sand, which confounds and incorporates the Mansion with the contiguous Earth. And now he lyes secreted from the Pursuit of ill disposed Birds; he rests in Oblivion, and lives in perfect Tranquillity; whereas he would infallibly be lost, were the Outside of this Habitation ornamental enough to attract the View of any Creature, whose Curiosity might prove injurious to him.

In this manner he lives, secluded from the World, six Weeks or two Months, and sometimes more, and then divests himself of his Eyes, his Horns, his Paws, and Skin. His Spoils sink to the Bottom of the Ball, like a Heap of Rags; all that now remains is a Nymph, who has other Eyes, and Paws, other Entrails and Wings enfolded with a Skin, and hid in a nutrimental Liquor that gradually dries around her, in the same Manner as is customary with all Papilio's, when they divest themselves of their vernicular Spoils, to assume the Form of Aurelia's. When the Limbs of the new Animal have acquired their necessary Tone and Activity, he tears away the Tapestry of his Apartment, and pierces through the Walls; for which Purpose he employs a couple of Teeth, like those with which the Grasshopper is furnished. And now he makes his Efforts, enlarges the Opening, thrusts out half his Body, and at last entirely quits his solitary Seat. His long Form, that winds like the Volute of an Ionic Capital,

tal, and possesses only three Twelfths of an Inch in Space, begins to unfold and extend itself, and, in an Instant, stretches to the Length of an Inch and three or four Twelfths. His four Wings, that were contracted in little Folds, and whose Dimensions, did not exceed two Twelfths of an Inch, in the Film that sheathed them, begin to be expanded, and, in the Space of two Minutes, shoot into a greater Length than the whole Body. In a Word, the malignant Lion-Pismire assumes the Form of a large and beautiful Dragon-Fly, who after she has for some time continued immoveable and astonished at the glorious Prospect of Nature, flutters her Wings, and enjoys a Liberty with which she was unacquainted in the Obscurity of her former State; and as she has cast off the Spoils of her first Form, so she is likewise divested of her cumbersome Weight, as well as her Barbarity and pernicious Inclinations. In fine, she appears entirely a new Creature, is all Gaiety and Vigour, graced, at the same time, with a noble and majestic Air.

Along the Edges of standing Waters, one may find other Animals, like this in Form, * but painted with Colours much more radiant and lively, and their Original is also very different. The Insect that arises from the Lion-Pismire, lays her Eggs in the Sand, that her Young may be supplied with Food when it forsakes the Egg. Sand is no Part of its Sustenance, but then it facilitates its Manner of Life. The Creature immediately sinks a commodious Trench, and in less than an Instant, becomes compleatly skilled in Hunting and Geometry. The other Dragon-Fly, that flutters along the Surface of Ponds, plunges the Extremity of her Body into the Water, and there deposits her Eggs. The Animals that issue from them, inhabit the fluid Element for some time; after which they assume a new Figure, and live upon the Earth in the Form of Aurelia's; but I am not sufficiently acquainted, either with the Manner of Life, or Transmigration of this last Animal, of which there are several Species.

Countess. I advise you to inform yourself of their History, for it must certainly be very entertaining, if it prove as agreeable as that of the Lion-Pismire;

* M. Aubriet dessinat. au Jardin Royal.

and you have my Thanks for chusing such a pleasant Subject.

Chev. This Compliment belongs to the *Prior*, for I owe all my Materials to his Generosity.

Countess. I thought to acquit myself in my Turn; but what I have to offer may prevent the *Chevalier's* intended Walk; and therefore, I hope, you will give me Credit till To-morrow, and the Assembly, if you please, shall be held in my Apartment.

The End of the eighth DIALOGUE.

TESTA-

TESTACEOUS ANIMALS.

DIALOGUE IX.

The COUNT *and* COUNTESS,
The PRIOR, *and*
The CHEVALIER.

Countess. LET us walk in.

Count. To what Purpose, Madam, are all those Glasses so agreeably disposed?

Countess. They are a little Collation, I have prepared for your Entertainment.

Count. I perceive a Set of Sea-Muscles laid on a little Bed of Sand in the Water. Are we then to have these instead of fresh Oysters? The Regale is something new.

Countess. It is much better than your Lordship imagines, and I am very sure I shall have your Thanks for providing it. Do you see nothing particular in the Muscles?

Prior. I observe one quite open, and fastened with several Strings, to a little Clod. One would be apt to take it for a Tent in Miniature, with all its Apendages of Cords and Stakes.

Count. I see too others, that are likewise fix'd to the Vessels with fewer Threads. This is something extraordinary, and her Ladyship certainly designs to shew us a Set of Spinsters.

Countess. That is the very Affair, and the Thought occurred to me, when you entertain'd the *Chevalier* with the Work of Caterpillars, and Spiders; they were Land Spinsters, but there are others peculiar to the Sea: I had an accidental View of them, and was desirous of procuring you the same Entertainment.

Cheval.

Cher. For once, Madam, you are out of your Province; this is neither your Garden, nor the Nursery of your Doves and Poultry.

Countess. Very true; but then it belongs to my Kitchen, Six or seven Days ago, my Steward paid the *Ripier** for some Fish he had caught. I stopped a few Moments, to observe a Heap of Muscles that had been delivered to the Cook, and was surprised to see several little Packets of Thread; upon which the *Ripier*, with the usual Politeness of those People, gave me to understand, that the Muscles could not possibly be without it, and that it served them instead of a Cable, to keep them steady in their Mooring. This Information, I fancied, might produce something agreeable to you, and therefore I ordered him, when he came next, to bring me a couple of Stone Jars full of Sea Water, with a little Sand, and some live Muscles upon it. He acquitted himself of his Commission very well, and came sooner than I expected. I distributed the Water, as well as the Sand and Spinsters, into different Glasses, in order to observe the Event; and you may now see three or four of these Creatures at work. They certainly spin the Threads you observe, and which were not visible till Yesterday. With these Threads they fasten themselves, either to some Part of the Vessel, or else to the Sand, by a natural Habit, and to prevent the Water from washing them away; but how they make this Thread, I can't possibly comprehend.

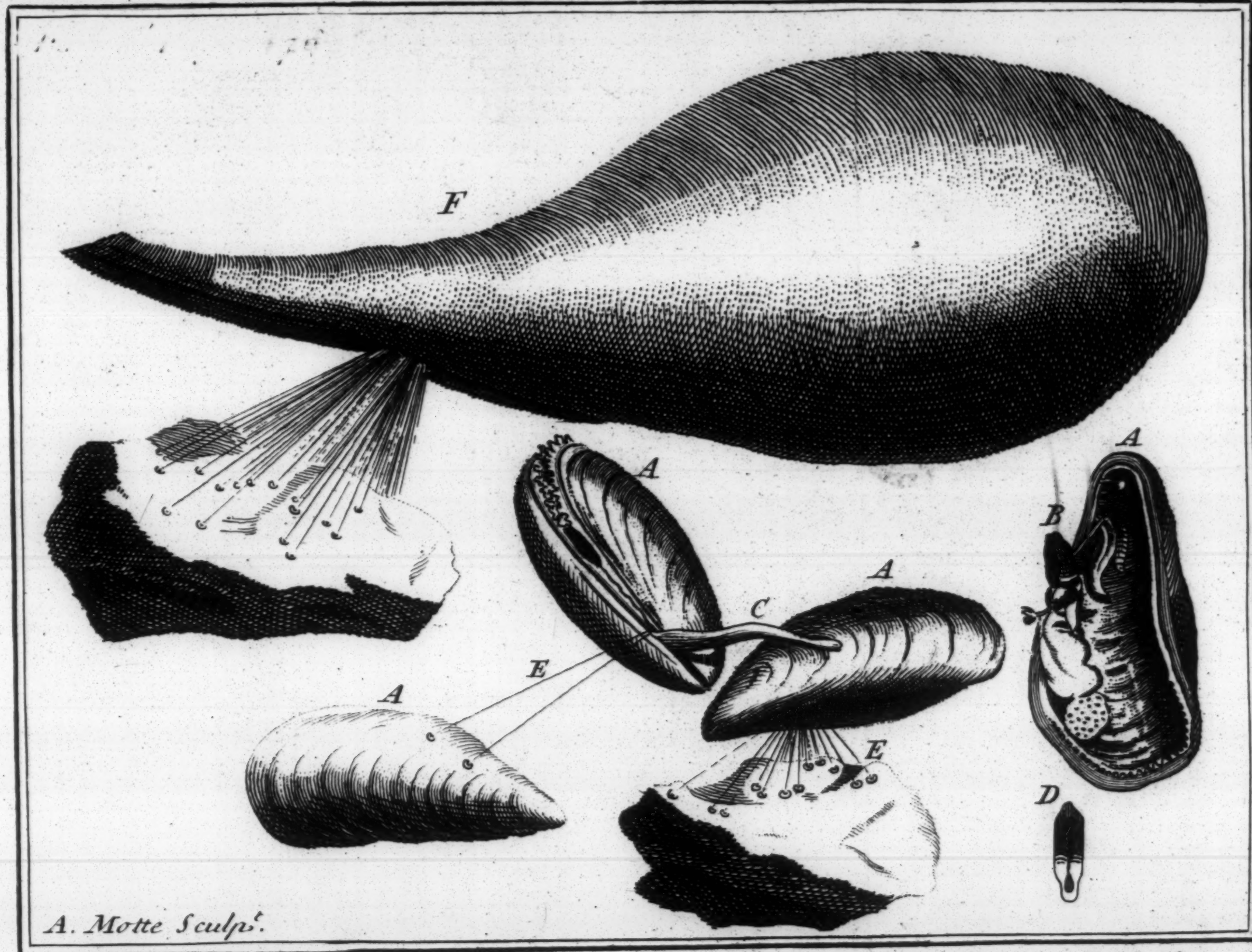
Count. Can you, my worthy *Prior*, distinguish any thing particular in the Work?

Prior. I observe, in the three first Glasses*, that the Muscle thrusts out of her Shells a kind of Trunk, or Tongue, with which she seems to be making Trials of the properest Places where to fix their Thread.

Count. I have heard, that all Shell-Fish, of the same Nature with the Muscle, have a kind of Trunk, and have frequently seen it, even those that have been boil'd. I

* A *Ripier* is one who brings Fish from the Sea-Coasts to the Inland Parts.

† *Memoirs de l'Academ. des Scienc. Monsieur de Reaumur, 711.*
know



A. A Muscle. B. its Tongue. C. the Tongue extended in order to find some firm Situation. D. the same Tongue forming a kind of Channel. E. the Threads which the Muscle forms with her Tongue and then fastens to some solid Body. F. The Pinna Marina or large Muscle fixed by his Threads.

know this Trunk performs the Office of a Foot, and enables these Creatures to move; they can likewise extend it, above an Inch and half, out of their Shells, and glew it to the Sand, but in what Manner, I am not able to declare; after which they immediately shorten it, and by these Means, move their little Habitation, and are capable of transferring it successive- Their Motion.
ly from one Place to another. But I perceive this Trunk is serviceable to them in another Instance, and her Ladyship seems to have guessed it extremely well. It is not sufficient, that the Animal finds Juices proper for its Nourishment, it must likewise be able to fix itself, in order to enjoy the Benefit of the Aliment; but, defenceless as it is, the first Blast of Wind, or the least Agitation of the Waves, which are commonly in Motion, along the Coasts where she finds her Provision, would hurry her to a great Distance in an Instant; and therefore these Strings, in what Manner soever they are made, were given her to fasten and keep herself The Thread.
steddily. Let us see if we can discover the Mechanism of her Work. Methinks I per- Its Mechanism.
ceive it; let us have a little Patience; for, I hope by the Assistance of this Microscope, to give you a good Account of the Matter. I see a kind of Channel or Furrow, run from one End of her Trunk to the other. The Muscle has brought the Sides of it together, and formed it into a Tube, and a Drop of Liquor is just now ejected out of the Extremity, that touches the Place she is fixed to.

Prior. That is very evident. The Drop has now assumed a round Form, and begins to thicken.

Count. I am apt to think, that the whole Trunk is as pliable as a thin Sheet of Lead, and rolls thro' its entire Length, into a round Form; whose internal Sides not being drawn so close together as to constitute a Solidity, a little Chanel is left in the Middle, through which the Gum, that forms the Strings, is projected; and this Gum is shaped in the Cavity of the Trunk, like a Wax Taper in a Mould.

Prior. That must certainly be true, for you may now see all the Trunk unfold itself, and return to a Flat. The Liquor, which is condensed in the Chanel, is disengaged from

from the Mould, by bringing the Tongue to its primitive Form; and you may now see a new Cord made, one End of which is inserted in the Stomach, from whence it proceeds, and the other terminates in the Substance to which it is fastened.

Count. It is plain the Animal is not yet sufficiently steddied, for I see the Trunk extended anew, and directed from Place to Place, in order to fix another Thread. Let us pursue her through all her Motions.

Chev. This is a Trunk that furnishes the Muscle with several Advantages: It is a Leg, to assist her in her Progress; a Tongue, to relish the Juices she tastes, and a Mould to shape the Thread for her fastening.

Count. I begin to be persuaded that her Threads are formed in the Manner we have represented, and can now comprehend how the great Sea Muscle is able, with a finer Instrument, to form Threads more valuable than Silk itself, and with which the *Sicilians* make Stuffs of incomparable Beauty.

Chev. But here arises a Difficulty. When the Muscle has eaten, or sucked up all that is proper for her in one Place, how does she disengage herself? These Threads must then be inconvenient to her.

Count. The *Chevalier* reasons very justly; but I have not seen the whole Succession of this Piece of Work, and consequently have nothing positive to offer as a Solution of the Difficulty; but it is certain, that the Muscles have a pregressive Motion, and can transfer themselves from Place to Place. From whence I conclude, that as they have a Magazine of viscous Matter, with which they form their Threads, and fasten them, at one End, to a Stone, so Nature has also supplied them with a dissolvent Fluid, which they pour, as they have Occasion, on the Extremity of their Cords, or they have some other industrious Method of restoring themselves to Liberty, in order to fix up their Tent in another Situation. They may possibly pass their whole Life in one and the same Place, like Oysters. I should be glad to live at a less Distance from the Sea. It is another World we are but little acquainted with, and, by our Success in the Experiment with which her Ladyship has entertained us, I am persuaded one might make several curious Discoveries.

Countess.

Countess. If we were to live near the Coasts that produce the large Sea Muscles, instead of the Manufacturers of gross Thread, I would have shewn you a Set of Silk Spinsters; the Sight of their Work would have been an extraordinary Curiosity; but what Advantage may one derive from it?

Count. * I have seen Gloves of this Silk; they are made at *Palermo*, and 'tis not impossible to procure you some.

Prior. I have seen Gloves made of a very different Silk.

Countess. What Sort?

Prior. The Silk, or Thread of a Spider. The Gentlemen of the Academy at *Montpelier*, sent them to be examined by the Academy of Sciences; and in a little Time after, with the same Materials, they wove Stockings and Mittans, that were presented to the Dutchess of *Burgundy*.

Countess. Since this Thread is so common, why have they not erected it into a Manufacture?

Prior. This was one of the Attempts of *Monfieur Reaumur*, who is generally striking into new Projects, that are very happy and important, even on the most common and neglected Subjects. This Gentleman endeavoured to collect a large Number of these Insects, and caused them to be fed with Flies, and the Ends of young Feathers, newly plucked from Chickens and Pidgeons, because such Feathers are full of Blood, and easy to be procured, and they are likewise a delicious Regale for the Spiders. But he was soon convinced, that all his Care to nourish them with their most palatable Food, was ineffectual; for there is such a Malignity in their Dispositions, when a Number of them are together, that they sacrifice all other Attentions to their natural Animosities, and are perpetually endeavouring to devour one another. You see then, these are a People incapable of being established into a Community; and tho' it were practicable to unite them in a Manufacture, it would require too much Room and Application to rear a competent Number. We may add to this, that their Thread is five Times finer than that of a Silk-Worm, and, by a just Computation, there

* *Memoirs de l'Academ. des Scienc. 1710. p. 386.*

must be sixty Thousand Spiders to produce one Pound of it; besides, it is not certain that there is any Possibility of manufacturing their common Thread; for that which has hitherto been used, is what they wrap their Eggs in, and four Times as strong as the Thread of their Web. In a Word, Madam, from the Result of all these Experiments, I doubt you must never expect to be well stocked with Gloves of this Manufacture.

Countess. I find then I must supply myself elsewhere.

Chew. I can easily comprehend how the Muscle, with the Assistance of her Trunk, can move and stop as she pleases; but I lately took a Snail from a Vine Leaf that hung at the Window, and saw him march without any Trunk, or Legs, to advance him in his Way. Pray how is this performed?

Countess. I am likewise in Pain, to know how the Snail, the Muscle, and all Sorts of testaceous Animals, build the House they always carry about them, and in what Manner they retire, when one touches them never so tenderly.

Prior. I have sometimes examined the Structure of a Snail with much Attention, and can give you the History of all that belongs to him, except the Formation of the Shell, which I reserve for his Lordship.

Here we are no longer entertained with
 The Snail. Plumes, nor Hair, nor Cones of Silk. This is a new Order of Being, wherein the Intentions are very different. Every Animal in Nature has an Habitation, and each Apartment its particular Beauties and Accommodations. The Roof under which the Snail resides, comprehends two Advantages, which, one would imagine, were incapable of being united, I mean an extraordinary Solidity, and an uncommon Lightness. By means of which the Animal is protected from all Injury, and easily transfers her House where she pleases; and in what Country soever she travels, is always at Home. At the Approach of the Cold, * she retires into
 Her Retreat. some Cavity, and her Body distils a certain Glew that condenses at the Aperture of the Shell, and entirely closes it up. When she is thus shrouded she passes the disagreeable Season, like a Number of other

* Memoirs de l'Academ. des Scienc. 1709.



A. Motte sculp.

Snails



Creatures, free from all Pain and Want. When the Spring paints the Earth with a new Bloom of Flowers, the Snail opens her Door, and seeks her Fortune; at which Time all her Necessities revive with her Appetite; but in her creeping Progress, and charg'd as she is with the Weight of her Apartment, if her Eyes were sunk as low as the Body she trails along the Ground, she could not perceive the Objects she ought either to avoid, or approach, and would at least be perpetually liable to plunge and soil her Eyes in the Dirt; to prevent which Inconvenience, Nature has supplied her with four Telescopes, to assist her in the Discovery of all Objects that surround her.

Chev. Have you ever seen, Sir, the Tubes of these Telescopes?

Prior. I assure you, Sir, I am not in Jest; and only acquaint you with a simple Fact. You are not to imagine, that those Projections which are commonly called the Snail's Horns, are really such. They are four Tubes*, with a Glass fixed in the Extremity of each; or they may be called four optick Nerves, ending in as many beautiful Eyes; and the Animal not only raises its Head to take a distant View, but also extends these four Nerves, and the Eyes in which they terminate, much higher. She lengthens and directs them as she pleases, so that they are real Telescopes, which she turns, and contracts, as she finds it necessary. The Eyes are very apparent in two of these Horns, and perhaps the other two are the Organs subservient to the Sense of Smelling.

Thus you have seen her lodged and illuminated. She is qualified to discover whatever may be commodious to her; but as she is destitute of Feet, how shall she march to obtain what she wants? This Defect is supplied † by two large muscular Skins, that Her Motion. are lengthened by letting them out; after which, their Fore-part is shortened into Folds, and that in the Rear falls into the same Contraction; by which Means they draw the Mansion that rests upon their Surface. But here another Difficulty arises: As she is constantly glewed to the Earth, and has neither Wings to raise her into the

* Lister, Exercit. Anatom. Cochl.

† Derham, Theol. Phys. l. ix. c. i. Lister, ibid.

Air, nor Threads to sustain her from falling, she must be exposed to the Danger either of tumbling from some Precipice, or being drowned in the first Water, wherein 'tis her Misfortune to plunge; and the very Humidity alone would penetrate and destroy her. But here Nature has interposed, and delivered her from all these

Her Glew. Inconveniencies, by replenishing her with a viscous Humour, that by its Cohesion, preserves her from falling, and renders her impenetrable to all Moisture, by the Ministration of an Oil, with which she closes all the Pores of her Skin. She manages this precious Fluid with great Frugality; in order to which she avoids the Sun that would evaporate it, and easily preserve it in moist Places, where it proves extreamly beneficial to her.

Nothing hinders her, at present, from searching out her Food; * and when she has found it, she

Her Teeth. cuts and divides it with two sharp Teeth, with which she sometimes makes great Devastations on the finest Fruits, the tender Buds of Plants, and even the Leaves themselves, on whose Preservation that of the Fruit likewise depends. You see therefore, that Nature has not neglected this Animal, as contemptible as she may appear to us, but has even furnished her with many peculiar Advantages.

But the most surprising Circumstance that attends these Creatures is this; they are all The Generation of Snails. Hermaphrodites §, and have the two Sexes united in them; so that each of them gives to the other that Fecundity which, at the same Time, is communicated to itself. When they are disposed to approach each other †, they signify their mutual Inclinations in a Manner peculiar to themselves; one launches against the other, a Kind of little Dart, which has four Wings, or minute Edges. This Weapon flies from the Animal, who shot it, and either lodges in the other, or falls down by him, after making a slight Wound; upon which

* Godart Insect. Tom. i. Lister de Cochl. Hook Micograph. Obs. 40.

§ Histoire de l'Academie des Scienc. 1708. p. 48.

† Lister de Cochl.

this Creature, in his Turn, dispatches another Dart at the Aggressor; but this little Combat is immediately succeeded by a Reconciliation. The Substance of the Dart is like Horn; and the Animals are stocked with them at the Seasons when these Approaches are made, and which happen each Year, thrice in every six Weeks, that is to say, once every fifteen Days: And each Insect, eighteen Days after every one of these Periods, deposits its Eggs in the Earth, and conceals them with extraordinary Care. My great Curiosity at present would be to know, if the Shell of the Snail is hatched in the Egg itself, and how it is augmented and repaired on every necessary Occasion.

Count. I can afford you some Satisfaction, Sir, in these Particulars; for I have made five or six Experiments that have succeeded perfectly well, and enabled me to answer all your Questions.

When the Snail leaves the Egg, she is array'd with the Shell compleatly form'd *, The Shell. and of a Minuteness proportionable to that of her Body, and the Dimensions of the Egg which inclosed it. This Shell proves the Basis of a second, which is perpetually increasing; and the little Shell, such as it is, at its Eruption from the Egg, will always be the Centre of the other, which the Animal, advanced in her Growth, forms and compleats, by adding new Circles to the first Shell: And as her Body can only be extended towards the Aperture, this must consequently be the Part that receives the fresh Accessions, the Materials of which are lodged in the Body of the Animal, and formed by a Liquor, or viscid Fluid composed of Glew, and several sandy Particles of an exceeding Fineness. These Ingredients are transmitted, through a great Number of little Channels, to the Pores, with which the whole Surface of the Body is perforated; but these being all closed by the Shell that covers them, the mixed Fluid is deflected to those Parts of the Body that advance out of the Shell, and are entirely destitute of any Covering; and now the Particles of Sand and Glew, transpire without Impediment, and thicken into a

* Malpighi Anatom. Plan. de Coch. Memoirs de l'Academ. des Scienc. 1709. Monsieur de Reaumur. Leuwenhoek's Arcan. Nat. Tom. iii. Ep. 2.

Consistence round the Extremity of the Shell. This viscous Matter is drawn out into a thin Film, under which a second is soon after extended, and this proves a Covering to a third. From the Union of these three Films, results an Incrustation of the same Quality with the rest of the Shell. When the Animal increases in Bulk, and the Extremity of her Body is not sufficiently covered, she continues to evacuate, and build in the same Manner: And by these Means, erects and repairs her Habitation. Some Time ago, I took several Snails, and broke off part of their Shells, without bruising the Animals. When this was done, I placed them under a Set of Glasses, and took care to accommodate them with a proper Quantity of Earth, and green Leaves; and then I immediately took Notice, that the same Part of the Body, which became visible by the Fracture of the Shell, was covered with a Kind of Froth, or Sweat, that flowed through all the Pores; after which I saw this Froth gradually raised, by a second Evacuation which flowed under it, and, in a little Time, lifted the Surface of the former, to a Level with the old Shell.

Prior. But is your Lordship sure, that this forming Juice flows from the Body of the Animal, and not from the Extremities of the adjoining Shell?

Count. I have as much Certainty as the Fact will admit, and this is the Method I took for my Satisfaction. When I had made the Fracture in the Shell, I took the little Skin that grows under the Shell of a Hen's Egg, and carefully inserted it between the Body of the Snail, and the Extremity of the Fracture; and if the Shell had then contributed to its own Reparation, the Juice that would have flowed from it, must certainly have been shed over the little Skin, and had covered it in proportion as the Cavity closed. As, on the contrary, if the Fluid proceeded from the Body of the Snail, this Skin would have prevented its Effusion to the Shell; and, in this Case, the Juice would settle between the Cuticle, and the Body of the Animal, which, in Reality, happened to be the Fact.

Prior. I have no Objection against this Experiment.

Count. I had another Method of satisfying my Curiosity, which was this: I broke off all the last of those four or five Contours, which compose the Shell of a Snail; after which,

which I drew, between the Shell and the Body, a slip of a Glove made of the finest Skin, the Extremity of which I afterwards folded over the Edge of the Shell, to which I fastened it with Glew. Now, if the forming Fluid had distilled from the Shell, it would have forced away the little Skin, instead of which it was not once moved; but then the third Part of the Snail and more, which remained exposed to the Air, was immediately covered with a Sweat that hardened into a Contour, which was joined to the old Shell in such manner, that the little Skin of the Glove lay between them, thro' the whole Progress of the Contraction.

Prior. I am very glad to see this Point cleared up, because the same Facts that explicate the Formation of a Snail's Shell, illustrate also that of all sorts of River and Sea Shell-fish. Let me beg your Permission then, to propose another Difficulty, for I am persuaded it will furnish us with new Discoveries. If the Shells then are formed, as your Lordship has been describing, and the Fractures they receive are repaired by a Matter that passes through the very same Perforations that originally ejected the Substance of the shattered Covering, the new Piece that fills the Vacancy should exactly tally in Colour with the old Fragment, as well as with all the rest of the Shell; and yet I have seen several Snails repair their Shell in such a manner, that the additional Piece was of a different Colour from all the rest.

Count. Your Observation does not destroy any thing I have advanced, and you now give me an Opportunity of explaining the Original of those Streaks and Clouds we observe, with Admiration, on the Shells of Snails, and the Generality of testaceous Animals.

The Spots
in the Shells.

Chev. I should be glad to know their Cause; for I have frequently viewed some Shells, where the Streaks were drawn, without any Intermission, from the little Point in the Middle, to the very Edges of the Aperture, and others, where these Streaks were discontinued, or intermingled with small Stains, which had no ill Resemblance to our Notes in Musick. What can occasion this Diversity?

Count. It proceeds from the different Disposition of the extreme Parts of the Animal's Body, that are visible at the

Aperture of the Shell, where one may frequently discover some minute Lobes or Lines of Flesh, that differ from the rest in Colour. This Variety demonstrates, that they have a different Texture from those that are contiguous, and consequently the Juices that flow into them, passing through Strainers, whose Perforations vary from those of the adjoining Parts, acquire a particular Complexion in that Place; and as these Lobes perform their Functions and Evacuations as well as the others, and in the successive Formation and Enlargement of the Shell, contribute their Proportion with the rest of the fleshy Substance that is from time to time, thrust out all the Points of the Shell that correspond with them, must inevitably assume the same Colour, and which differs from that of the contiguous Parts; consequently these Colours must be drawn out, and distributed into Lines and Rays, and continued in the same Manner, as long as the Animal persists in her gentle Motions, and makes new Additions to her Shell, by the repeated Protrusions of her Body.

But that you may the better comprehend this Work, it is necessary for you to know, that as the Animal increases in Growth, she draws her Tail from the Bottom of the Shell, that now becomes too little for its Reception. She then ascends higher, and fixes her Tail near the second or third Contortion of her Shell, and enlarges her Apartment at the Opening. As she makes these Advances by little and little, and ascends from Point to Point, as they lye contiguous to each other; those Parts of her Body, in the Aperture of the Shell, that, by the Diversity of their Pores, cause this Variation of Colours, form one continued and regular Streak; but when the Animal, in changing her Situation, leaves an Interval between the Point from whence she removes her Tail, and the new one to which she fastens it, all the other Parts of her Body move in the same Proportion, and those in the Orifice of the Shell, that impress the Stains, being transferred to some Distance from the preceding Speck, tinge the Shell so, as to leave a Space of more or less Extent between each Spot, and this is the Origin of the *Chevalier's* musical Notes. Different Causes may concur to paint and vein the Outside with Colours, more or less lively in their Glow. The Quality of the Food, the Health or Indisposition of the
Animal

Animal, the Inequality of her Constitution, according to the several Periods of her Age, and the Changes that may happen to the different Perforation of her Skin: In short, a thousand Accidents may intervene, to heighten or diminish certain Tints, and diversify the whole to Infinity.

If the Shell, in the Variety of its Colours imitates the Diversity of the Animal's Pores, it is still more apparent, that it must assume the Form of the Body on which it is moulded. Thus we observe, in all

The Tumours and Inequalities of the Shell.

Sea Shells, that if the Animal has any Swelling or Inequality on its Body, a Tumour likewise rises in the corresponding Part of the Incrustation. When the Creature displaces herself, and enlarges the Dimensions of her Dwelling, the same Tumour, which had already raised the Shell in one Part, swells it anew at a little Distance, by which Means you see the same Species of Inequality, in a winding Line round the Shell. Sometimes these Protuberances of the Animal are so large, or so pointed, that those which rise over them, in the Shell, are like Horns. She afterwards fills the Inside of these Cavities, and then, by new Evacuations of Sweat, strikes out another Set of Horns, that protect her from Fishes, who are fond of Flesh. If her Body happens to be channel'd, the Shell that covers it has the same Configuration: If the Flesh rises in Swellings, that wind round her in the Form of a Screw, the Shell has likewise its Elevations and Depressions, that are carried on in a spiral Line, from her Tail to the Extremity of her Body.

Prior. His Lordship's Exactness in this Account of the Formation of Shells, is confirmed by what we ourselves frequently see. Nothing is more common than to find, in the Aperture of a Snail's Shell, and along the Rims of the two Shells of a Muscle, a little Film, which is only the Sketch, or first Plan, of the Addition the Animal intends to make to her Habitation. Beside this, when you throw the Shells of Muscles, Snails, or Oysters into the Fire, the Heat shivers them into thin Plates, or rather separates the different *Strata* of Matter that compose the Shell, and makes them visible by drying, or evaporating the Glew, and Salts, which caused these *Strata* to cohere.

Chev. Since we are upon Shells and Oysters, I hope his

Lordship will be so good as to inform me from whence could proceed the two little Pearls, we found in one of the Oysters that were brought to Table Yesterday.

Count. My Thoughts upon the Matter, Sir, amounts to no more than this; the Oyster was afflicted with the Gravel *.

Chev. Is your Lordship serious?

Count. Perfectly so.

Chev. How! are these Pearls, which we so much admire and purchase at so great an Expence, the Effect of a Distemper in the Animal who produces them?

Count. If the Fact be not certain, 'tis at least extremely probable. The Juice or Grew with which Oysters and large Sea-Muscles form, by Transpiration, the first Structure, and future Enlargements of their Shell, is sometimes extravasated and forced out of its natural Repository. It is then amassed in Drops, and hardened into little Balls or Globules, resembling the Shell in Colour, and these are the very Pearls you enquire after.

Prior. It is certain, that the Pearl and Shell are exactly of the same Complexion, which makes it probable that they are both composed of the same Materials. In a Journey which I took twelve Years ago to the Southern Parts of *France*, I had an Opportunity of seeing the two Ports of *Marseilles* and *Toulon*. In the last of these, they shewed me some large Sea Muscles, whose Shell was above two Feet in Length. Upon opening them, we found several Pearls, some red, and others coloured like Mother of Pearl; but the red Pearls were in that Part of the Animal, where the Lobes of her Flesh tinged her Shell with a red Dye; and the Pearls of the Colour of Mother of Pearl, were lodged in that Part, where the Shell was tintured with the same Hue; which shews the perfect Conformity there is between the Juice which forms the Shell, and that which constitutes the Pearls. I may add too, that for one Pearl which is found in the Body of the Oyster, there are a thousand fastened to the Mother of Pearl, where they form as many Warts.

* *Memoirs de l'Academ. des Scienc.* 1717. *Monsieur de Reaumur.*
Actes de Leipf. 1586. *Bonanni.*

But let us take Notice of all that can be advanced against this System. Crabs divest themselves of their Shell every Year, and eject a Liquor that glides over their whole Body, and which, by Degrees, growing dry and hard, changes to a Shell, as strong as that they cast off. At the Approach of this Moulting-time, if I may so call it, one finds in the Body of this Creature, certain Stones, which are improperly called its Eyes. These Stones decrease in Size, in proportion as the new Shell consolidates, and are not to be found in the Animal, after the Shell is compleated; which Observation made a celebrated Member of the Academy affirm, that these Stones were the Magazine or Stock of Matter, which the Crabs employed in the Renovation of their Shells. May not the Case be the same with the Oyster and its Pearls, as it is with the Crab and its Eyes? And may not these Pearls be a Reserve of Materials, appropriated to repair the Shells in the time of Need?

The Shell and
Eyes of Crabs.

Count. Your Comparison seems, at first, a little embarrassing, but, upon a nearer View, it favours my Purpose. Whatever constitutes the essential Part of an Animal, is to be found in each Individual of the Species, and it is not probable that Nature should, only in some Instances, afford that to them which they cannot by any Means subsist without. On the contrary, that which is a Default in an Animal, is only found in some of the Species; for no Default can be universal. The Stones in Crabs, that seem necessary Materials for the Reparation of their Shell, are to be found in the whole Species of these Creatures, at the Time when they change their Covering. But there are vast Quantities of Oysters, in which Pearls are never discovered, from whence we may infer, that the Pearls are a Default in the Oyster, and a Default too not very common. If the Pearls were the Stock of Materials with which the Oysters renewed or repaired their Shells, every one of these Animals would have its particular Magazine.

Beside, it has been observed by Travellers, that the Coasts where the Pearl Fishery is transacted, are unhealthy; which makes it very credible that the Oysters caught there, owe their Pearls to some Indisposition that affects them. The Spaniards have abandoned this Fishery in America;

Gemelli.

and it is certain, that the Air and Water of the Isle of *Baharen**, from the Banks and Rocks of which the Divers bring up Oysters, are insupportable to those who trade there for Pearls; nay, the very Peasants have such an ill Opinion of the Oysters which produce them, that they never eat any. On the contrary, the more delicate our Oysters are, the fewer Pearls are found in them; from whence it is natural to conclude, that the Waters which afford the greatest Quantities of these pearly Fish, are unwholesome; whereas the Oysters that either live in a more salutary Fluid, or are nourished with kindly Juices, produce few or no Pearls, because their Temperament is free from all Sicknefs and Disorder.

Prior. I submit, my Lord, for your Account appears to me very satisfactory.

Count. Though the *Chevalier* is not unacquainted with Testaceous Animals, yet if he will step into my Closet, he shall see such a Collection as will entertain him exceedingly, with the Richness and Variety of their Colours. He will see in that little Space, some of the Curiosities of the four Quarters of the World. Some Persons distribute them into different Classes, and call each Shell by the Name of what it most resembles. There is no extraordinary Merit in the Ability of giving each Class its Denomination; but it has its Use, because you, by these Means avoid Confusion, and can methodize this Part of Natural History. One is infinitely affected at the Sight of this prodigious Variety of Species, that are constantly propagated with the compleatest Similitude, through every Age: They are all formed upon the same Design, which is, to protect the Animal from Injury. But what a surprizing Variety flows from the Execution of this single Design? They are all invested with Perfection, Graces and Advantages, accommodated to their Nature: Industry and inexhaustible Sources are conspicuous through every Tribe. Some curious Persons, who are not so studious of the Natural History of those Shells, as they are of the different

* In the Persian Gulph.

Effects they are capable of producing, by the Assemblage and Disposition of their amiable Colours, make large Collections of them in all Shapes, and work them into artificial Rarities of a peculiar Taste; such as Sprigs of Flowers, Garlands, Grotto's, Landscips, Architecture, and Figures of Men and Animals, the whole composed of large and little Shells. This sort of Work requires much Patience, and sometimes a great Share of Genius and Ingenuity. My Desire, in shewing you my Collection, is to give you a better Idea of what I have told you, with Respect to the Manner of their Formation.

Chev. I shall be exceedingly pleased to repeat your Observations, and compare them with the Shells themselves; but I forget to let you see three or four which I have carried in my Pocket a considerable Time; but they are very pretty in their Kind, and here they are.

Count. These are all petrified.

Chev. Petrified! Pray what may your Lordship mean by that?

Count. My Meaning is, that the Shell, as well as the inclosed Oyster, by lying in some Fluid of a petrifying Quality, have assumed the Nature of Stones without changing their own Figure.

Chev. I cannot comprehend what Oysters your Lordship means; for Oysters are taken in the Sea, but I found this on a Mountain. Some short time before my Father went to *Amiens*, he covered his Parterres and Walks with Sand. Adjoining to his Estate are two Hills, where his Servants went to get two different Sorts of Sand, and each of a most agreeable Colour; the one Grey, and the other Yellow, tending to Red. Every time I went to see the Workmen, who were employed in digging the Sand, they gave me some of these Shells, which they often found in little Heaps, and they must certainly be of a different kind from those found in the Sea.

Prior. Very well, Gentlemen, I find you are agreed in the same Design. Farewel Insects, and Shells; you are going to examine the History of the Earth, as it was before the Deluge. You see the Subject is pretty extensive, and I must take my Leave.

Count. No, Sir, I beg the Favour of your Company
H 5 for

for a Moment. We shall want your Assistance; and a short Digression on the *Chevalier's* Question, will be more instructive to him than Pearls of the brightest Hue. My dear *Chevalier*, I will shew you immediately, in my Collection, three Shells that are precisely the same as yours, and both the one and the other have floated in the Waves of the Sea.

Chev. Who then has been at the Pains to carry them into the Heart of a Mountain?

Count. The Sea itself.

Chev. But I have heard, that the Sea never passes beyond certain Limits; and tho' by the Effect of some Tempest, or other Accident, it should happen to overflow the neighbouring Plains, it can never extend itself to the Distance of twenty Leagues and more, for our Estate lyes as far as that from the Sea.

Count. How, *Chevalier*! Can't you guess when this Event happened? Would not the Difficulty you are under increase upon you, should I tell you, that in the very middle of *Africa** there are Plains full of Shells, above three hundred Leagues from the Sea, and that Heaps of them are piled up, on the Top of the *Alps* themselves? You now find the Sea flowing over the Mountains. How shall we solve this Inundation?

Chev. On the contrary: I find the Difficulty begin to lessen. The Mass of Shells must certainly be convey'd to these Places by the Waters, when they deluged the whole Earth, and swelled fifteen Cubits above the highest Mountains. Give me my Shells again, if your Lordship pleases, for they are Curiosities older than the Flood.

Prior. It is certain, that all Nations have retained a Remembrance of the Deluge, and even the Poets have not lost the View of it, amidst the Obscurity of their Fictions. The whole Earth is covered with indelible Monuments which attest the Progress of the Waters; and the universal Deluge is an Event, whose Proofs are still presented to our Observation, in what manner soever it was occasioned, and as incomprehensible as it may appear.

* Hist. & Memoirs de l'Academ. des Scienc. presque chaque année.

From whence results an important Truth; and let me intreat you, *Chevalier*, to fix it in your Memory; it is this, There are, both in Nature and the sacred Writings, many Particulars above the Reach of Man's Conception; but the Reality of whose Existence does not, for all this, cease to be certain, and capable of Demonstration.

The End of the FIRST PART.

OF THE HISTORY OF THE

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Part the SECOND.

B I R D S.

D I A L O G U E X.

The COUNT, *and* COUNTESS.

The PRIOR, *and*

The CHEVALIER.

Countess. **Y**OU seem to be at a Loss, Gentlemen, for a new Subject of Conversation. Let us proceed to Birds. Will you be always creeping on the Earth, with your Snails and Reptiles?

Prior. Let us take our Flight from terrestrial Dross, and grow acquainted with the Inhabitants of the Air. All the Universe you see, is replenished with Life: Every Part of Nature abounds with Action, and its proper Animals: You cannot proceed one Step without discovering new Traces of a Wisdom as inexhaustible in the Variety of its Plans, as in the Richness and Fertility of the Execution. Cast your Eyes on that Bird, who wings the Air; nothing is more natural to Eyes that have been habituated to such a Sight, and nothing is so astonishing to the Optics of Reason. It is evident, that a Passage through the Air, which

which has been denied to other Animals, is open to these. The Fact is certain; and yet seems to be altogether impossible. A Bird in Flight, is a Mass rais'd aloft in spite of the Weight of the Air, and the powerful Gravitation impress'd on all Bodies, and which impels them to the Earth. This Mass is transported, not by any foreign Force, but by a Movement accommodated to the Purpose of the Bird, and which sustains her a long Time with a graceful Vigour. This is another Subject of Admiration. I consider all these Birds, I see each Individual furnished with no more than two Wings, and yet I observe them all flying in a different Manner: Some launch away in repeated Springs, and advance by successive Boundings; others seem to glide through the Air, or cleave it with an equal, and uniform Progress. These always skim over the Earth; those are capable of soaring up to the Clouds. You will see some who know how to diversify their Flight, to ascend in a right, oblique, or circular Line, to suspend themselves and continue motionless in an Element lighter than themselves; after this, to start into an horizontal Motion, and then dart themselves either to the Right, or Left, wheel into a contrary Track, remount, and then precipitate themselves in an Instant, like a descending Stone; in a Word, they transport themselves, without Opposition, or Hazard, where-ever their Necessities or Pleasures invite them. When I am conversant with them in their Habitations, I still find them equally surprising. I am enchanted with the Structure of their Nests, the Solitude with which they attend their Eggs, the Mechanism of the Egg itself, and the Birth and Education of their Young.

Countess. The *Prior*, in his Enthusiasm, has given us an agreeable Disposition of the Particulars of our Entertainment. I charge myself with the Nest, and domestic Employment of the Bird, for I would willingly have my Part, as well as the rest. Do you know where I pursued my Studies? Truly with my Finches, my Pidgeons and Ducks; I know each particular by Heart.

Count. Indeed, Madam, they are the best Books; and the Portraits you copy from Nature, will always have the finest Likeness.

Chevalier. Her Ladyship has had an Opportunity of observing several particular Curiosities in that delightful
Bower

Bower which the *Count* has inclosed with a Lattice of Brass Wier. I think I have seen in this charming Aviary all imaginable Sorts of little Birds, as well as those of a middling Size.

Countess. *Chevalier*, this Aviary boasts a little of my Invention, and I commonly undertake the Management of it, but my Pains are requited by Pleasures that vary every Day.—The Contentions of these little Creatures, their Endearments, their Melody, and Labours, and the obliging Civilities I receive from the Generality, when I pay them a Visit, are extreamly entertaining to me. I carry my Work to them, and am never alone. One may pass whole Hours and Afternoons there, without finding the Conversation languish, and it seems to me, to be that Part of the House for which the *Chevalier* has the greatest Fondness.

Chevalier. I am surpris'd we don't every where meet with such an easy Amusement. But what prevents us, Madam, from adjourning the Assembly to the Aviary? We can't talk of Birds in a more proper Situation; we shall have a full View of them all, when they come by Turns to play, and drink on the Edges of the little Canal that runs through the Bower.

Countess. I have lately seen a Couple of new Broods*, though the Season be far advanced. The Affair is of some Importance, because they are two Species, I am very desirous of preserving. Long Visits, and abundance of Company discompose them, and make them frequently forsake their Eggs; but, without invading the Liberty of our Solitaires, I will acquaint you with the Structure of their Nests, as well as if they were before your Eyes.

I am never tired with observing the perfect Similitude that appears in all the Nests of Birds of the same Species, the Difference between the Nest of one Species, and that of another, and the Industry, Neatness, and Precautions, which reign thro' the whole. As my little Prisoners cannot make Excursions for the necessary Materials to build their Nests, I

The Nest.

* The Goldfinch, Greenfinch, and others, sometimes build their Nest in August and September. These Exceptions, which are very rare, don't destroy the general Order remark'd elsewhere.

take care to supply them with every thing I imagine can be agreeable to them, and am curious to observe what composes those Nests the Children bring me from all Parts; accordingly I throw into the Aviary, Sprigs of dry Wood, Shivers of Bark, and dry Leaves, Hay, Straw, Moss, Down, Wool, Silk, Spiders Webs, Feathers, and a hundred other little Materials that are all useful in the Nest. You would smile to see the Inhabitants come to traffick at this Fair: One wants a Bit of Moss; another has occasion for a Feather; a third can't do without a Straw; you will see two out-bidding one another for a Lock of Wool, and this sometimes causes great Quarrels; however, the Difference is commonly adjusted, and each carries what she can to the Nest.

They are as well furnished with Provisions too, and I have appointed a Steward, or Purveyor for them, who waits on them with Worms, Caterpillars, Flies, besides several Sorts of Seeds, and who serves them all according to their Appetites in each Season. One finds a great Advantage in bringing them up in this Manner, under a green Covering. They enjoy a better State of Health, act with more Freedom, and one has a better View of their various Characters and Labours.

One Species builds its Nest on the Top of Trees. Another chuses to settle on the Ground, under a Canopy of Grass, but where-ever they dispose themselves, they are always accommodated with a Shelter, and either make choice of Herbs, or a shady Branch, or a double Roof of Leaves, down the Slope of which the Rain trickles, without entering into the little Opening of the Nest, that lyes conceal'd below. The Nest is raised on more solid Materials, that strengthen it with a Foundation; for which Purpose they make Use of Thorns, Reeds, thick Hay, and compact Moss. On this first Lay, that seems very shapeless; they spread, and fold in a Round, all the most delicate Materials, which being closely interwoven, prevent the Access of Winds and Insects. But each Species has a particular Taste in the Building and Furniture of its Apartment, and when this is compleated, they never fail either to hang the Inside with a Tapestry of Feathers, or quilt it with Wool, or Silk itself, in order to communicate a convenient Warmth around them, and their Young. When
their

their Supplies fail them, there is scarce any Invention, to which they have not Recourse for a Recruit; and this is what I learnt from the first Thistle-Finches I bred: I only furnished them with Hay for the Structure of their Nest, and the Female, for want of Raw-Silk, or Cotton, found out an Expedient that surpris'd me. She began to unplume the Breast of the Male, without the least Opposition from him, and afterwards hung all the Apartment very artificially with the Down.

Chevalier. This indeed is astonishing. Who acquainted this Mother that she would have Eggs, and Young, and that these Eggs could not be cherished without Heat?

Prior. Admire the Skill and Industry, as well as the provident Care of this Creature; or if you will not allow her to be Mistress of these Qualities, acknowledge their amiable Display in Him who furnished Man with the Gift of Reason, that extends to every thing round him; and who inspired Animals with an Imitation of this Reason, limited indeed to a single Point, but admirable in that very Limitation. For is it not an infinite Reason that directs the Labour of this Bird, when she builds her Nest? Who informed her she should lay Eggs, and would want a Nest to preserve them from falling, and cherish them with a genial Heat? that this Heat would not be centered round the Eggs, were the Nest too large, and that the Nest would be incapable of containing all the Young, were she to give it less Dimensions? How comes she to know its just Proportion and Extent, with the Number of Young to be born? Who has regulated her Almanack, that she might not miscalculate the Time, and lay her Eggs, before she had compleated her Nest?

Count. There is one Circumstance that astonishes me yet more. The Workman who makes a Basket, is furnished with Fingers and Implements. The Mason has his Hod and Trowel, his Line and Square. But the Inhabitants of my Aviary, who accomplish Works of every kind, have no Utenfil but their Bill.

Countess. Forgive me an odd Thought that comes into my Head. Let us suppose *Dædalus*, or any other Architect you please, to be transformed into a Bird, no longer accommodated with Arms, or Tools, or Materials, and Master of nothing but his Science and Beak. How will he

he employ them? The Bird indeed has a Beak, but no Science, and yet she forms Works that discover all the Propriety of the Basket-maker, and all the Industry of the

Mason; for in some of these Nests, the Hairs and Reeds are interwoven with great
 The Nest of a Titmouse. Dexterity: * Others have all their parts properly fastened and connected with a

Thread which the Birds spin from a Flew, as well as from Hemp and Hair, and generally from the Webs of Spiders, which she easily procures when these wandering Creatures dart from Place to Place, and fill the Fields with their Threads, by the Assistance of which, they change their Situation, and go in quest of Company. † There are other Birds, such as the Blackbird and Lapwing, who after they have made their Nest, rough-cast the Inside with a small Lay of Mortar, that glews and supports all below; and by the Aid of a little Flew, or Moss, with which they temper it when it is fresh and soft, form a compleat Wall within; let us rather call it an Apartment, commodiously furnished, and properly calculated to preserve the necessary Warmth. I have frequently, from my Window,

The Swallow's Nest.

seen the Swallow either beginning, or repairing her Nest, which is a Structure entirely different from all others: She wants neither Wood, nor Hay, nor Bands, but knows how to make a kind of Plaster, or rather Cement, with which she erects a Dwelling equally secure and convenient for herself and all her Family. She has no Vessels to receive the Water she uses, nor a Barrow to convey her Sand, nor a Shovel to mix her Mortar; but I have seen her pass and repass over the Basin in the Parterre; she raises her Wings, and wets her Breast on the Surface of the Water, after which she sheds the Dew over the Dust, and then tempers and works it up with her Bill. But I try your Patience, *Chevalier*, and am sensible I am a little extravagant in my Fondness for Birds.

Chevalier. Let me intreat you, Madam, to continue your Account, for I am charmed with hearing you. Pray

* Derham, Theol. Phys. l. viii. c. 4. rem. 5. Raii Synops. Avium, p. 74.

† Willughby's Ornithol. p. 140.

what succeeds when the Nest is compleated?

Countess. The Dam then lays her Eggs, The Brood. the Number of which varies according to the Species: Some have only two at a Time; others four, or five, and some eighteen. When the Eggs are laid, the Male and Female brood over them by Turns; but this is generally the Female's Province. And here we must unavoidably admire the Impressions of a superior Reason that acts upon these little Creatures: They have no certain Knowledge either of what their Eggs contain, or of the Necessity there is to sit on them, in order to hatch them, and yet this Animal, who is so active and unsettled at other Times, in this Moment forgets her natural Disposition, and fixes herself on the Eggs as long as is convenient; she submits to Restraint, renounces all Pleasure, and continues almost twenty Days, inseparable from her Brood; and that with a Tendernefs so extraordinary, as makes her forget to eat. The Male, on his Part, shares and alleviates her fatigue, he brings Food to his faithful Mate, repeats his Journeys without Intermiffion, and waits on her with the Collation ready prepared in his Bill; his Services are accompanied with the politest Behaviour, and if he ever discontinues his Assiduity, 'tis to entertain her with his warbling: He acts with so much Fire and Alacrity, and puts on so many Graces in his Departures, and Returns to serve her, that one is at a loss to know, whether the painful Perseverance of the little Mother, or the officious Inquietude of her Spouse, are most to be admired.

Perhaps the *Chevalier* will not be displeased at my acquainting him with the Cares they undergo in the Education of their Young, but it would not be improper, before this, to give him a Description of what the Egg contains, as well as of the Manner in which the Young is there formed, and how it afterwards issues from its Confinement. An Egg is a very common Food; but, dressed in a particular Manner, may prove an agreeable Regale. Can you, learned Gentlemen, tell us what an Egg is?

Count. It would be easy for me to fatigue you with too much anatomical Exactness. Let us therefore content ourselves with an unpolished, but true Description. * One

* Malpighi de ovo incubato.

may

may judge of the Eggs of the smallest Birds, by that of a Hen, where the Parts are more apparent. * We may easily distinguish the Yolk in the Heart of an Egg, as likewise the first white Substance that surrounds it; and a second White, in which the Mass in the Middle swims: Besides these, we can see the Ligaments that sustain the Yolk, towards the Centre of the Egg, and can likewise discover several Membranes; one of which enfolds the Yolk, another the first white, a third and fourth encompass the whole; and lastly, we see the Shell formed for the Defence and Preservation of all the rest. What lyes within these Inclosures has the first Formation, the Shell has the last, and hardens from Day to Day; 'tis a Fluxion of Salts evacuated from the Humours of the Dam, and which the Heat fixes and consolidates round the Egg, to form a Crust, that has a double Function; one qualifies the Mother for discharging the Egg without crushing it, the second preserves the Young from all Accidents, till it be formed, and in a Condition to forsake the Egg. † We may even say, that the Egg performs to young Birds, the Office of a Breast and Milk, with which the Offspring of other

Animals are nourished, because the little
 The Chick. Chick, who lyes in the Egg, is first sustained with the White of the Egg, and afterwards with the Yolk, when the Animal has gathered a little Strength, and its Parts begin to be fixed. Under this Membrane which surrounds the Yolk,

The Cicatrice. is found a little Cicatrice, or white Spot, which is only the Seed, where the Chick resides in Miniature. It has all its Organs, at that Time, but they are wrapped up, and comprehended in a Point. If the smallest Portion of that vital Spirit, which is destined to animate the Mass, be then infused into it, by a Process of which I have no Idea; the Chick receives Life at the same Instant, and its whole Substance is then in Motion. We have no adequate Conception, indeed, of a vital Spirit; but this Expression points out a Reality, which is sufficient for our Purpose.

* Willughby's Ornithol. l. i. c. 3.

† Leuwenhoek, Ep. phys. 40. Willughby, *ibid.*

Prior. We have a Privilege to use this Term, without comprehending it; as we mention the Word Sun, without acquiring a competent Idea of that Luminary.

Count. When the vital Principle has not been infused into this Speck, which comprehends, not only the first Sketch, but every Part of the Chick, the Dam may sometimes lay that Egg, but it will contain nothing more than an unprolific Nourishment, and will never be a living Animal. On the contrary, should this enlivening Spirit be transmitted, in the minutest Degree, thro' the Pores of those Membranes, thro' which such a Diversity of Aliments has already flowed, it will then open the small Vessels of the Chick, diffuse a general Warmth, and convey a nutrimental Fluid to the Heart. The Structure of this little Muscle enables it to open and dilate, for the Reception of what passes into it on one Side, and likewise to contract itself, for discharging thro' another Orifice, what has been already received. This Pulsation of the Heart has some Analogy to the Pendulum of a Clock, from whose Vibration, the whole Machine derives its Motions. The Moment the Heart begins to beat, the Animal is alive, but still continues to receive, by the Mediation of the umbilic Duct, a Flow of nutritious Juices, which it transmits into the other Vessels, whose Branches distribute this Nourishment thro' the whole Body. All those little Canals, which were flat before, are now swelled and enlarged; the whole Substance imbibes a proper Aliment, and the Chick begins to grow.

It is almost impossible to distinguish, amidst the Fluids that surround it, the Nature of its daily Progress and Changes, till the Period, when it issues from the Shell. But let us not omit one Precaution, equally evident and astonishing, and which is observable in the Situation of the Speck, out of which the Animal is formed. This minute and globular Particle of Matter, which is lodged on the Film that enfolds the Yolk, has always its Position near the Centre of the Egg, and towards the Body of the Dam, in order to be impregnated with a necessary Warmth. As the Wick of a Mariner's Lamp is constantly preserved near the Surface, by the Mobility of the Slings of the Lamp, and the Weight of the Vessel of Oil, which always tends downwards, notwithstanding the Motion of the Ship;
some

some Contrivance of this Nature, prevents the Young from being overthrown, upon any Removal of the Egg.

The Liga- The Yolk is sustain'd by two Ligaments,
ments. visible at the Aperture of the Egg, and
 which fasten it, on each Side to the com-
 mon Membrane glewed to the Shell. Should

a Line be drawn from one Ligament to the other, it would not exactly pass through the Middle of the Yolk, but above the Center, and would cut the Yolk into two unequal Parts, so that the smaller Part of the Yolk, which contains the Seed, is of Necessity raised towards the Belly of the Bird who performs the Incubation; and the other Part being more gross and weighty, always descends as near the Bottom as the Bands will permit; by which means, should the Egg be displaced, the Young could not receive any Injury; and whatever may happen, it enjoys a Warmth that puts all about it in Action, and by Degrees compleats the Disengagement of its Parts. As it is incapable of sliding down, it nourishes itself in Ease, first with this liquid and delicate White, which is adapted to its Condition, and afterwards with the Yolk, which affords a more substantial Food. And when its Bill is hardened, and the Bird begins to be uneasy at his Confinement, he endeavours to break the Shell, and does so in Effect. After which he issues out, fully replenished with the Yolk, which nourishes him a little longer, 'till he has Strength enough to raise himself on his Feet, and can march about to look for Provisions, or until the Parents come themselves to supply him.

Prior. From his Lordship's Observation, that some of these Young, when they abandon the Shell, are fed by their Parents, and others seek their own Provisions, I have happened on a Thought which I shall propose to the *Chevalier*. The Birds who nourish their Young, have commonly very few; on the contrary, those whose Young feed themselves, when they first see the Day, have sometimes eighteen or twenty in a Brood, and sometimes more: Of this last kind are Quails, Pheasants, Partridges, and Hens. Why then has the Dam who sustains her Young so small a Number, and why has she such a numerous Off-spring, who only walks at the Head of them, and never supplies them

them with Food? Do you impute this Difference to the Sagacity of the Parent, or the Capriciousness of Chance?

Chev. There is no Capriciousness in this Fact, but rather an extraordinary Prudence, which could only be impaired by him, who has regulated all Things to the best Advantage. The Dam who charges herself with the Care of seeking Provisions, has but an inconsiderable Brood; were it large, both the Parents would be Slaves, and the Young but indifferently accommodated. As to the Mother who marches in the Van of her Progeny, without nourishing them, she can conduct twenty as well as four: This is a Demonstration rising before our Eyes.

Countess. 'Tis very true, *Chevalier*, but who has these Eyes? You make me open mine to a Truth I was not sensible of before. You tell us of one Set of Young, who are nourished by their Parents, and of another who seek their own Food, but how do these latter get what they want? Have they any Market where they may be sure of finding their Provisions? And how are the Cries of the former, who cannot make Excursions for Sustenance, heard on the Spot? Has the Father of these little ones any Magazine in which he hourly finds a sufficient Supply for his whole Family?

Chevalier. They are all nourished by one common Father.

Prior. He opens the great Magazine of the Fields, where they are all accommodated according to their Necessities. There they find Caterpillars and Worms, for their Young. The Atmosphere likewise supplies them to a very considerable Height, with innumerable Flies and Gnats, the Generality of which are imperceptible to our View. When the Density of the Air causes these little Insects to descend, the Birds lower their Flight, and descend in Proportion. The Earth also furnishes them with Beetles, Snails, and Seeds of all Kinds, which are their Food when they are advanced in Strength; even Frogs, Lizards, Serpents, and those very Animals we apprehend to be most pernicious, are a delicious Regale for Storks, and a Variety of other Tribes. God opens his Hand, and every Animal lives.

Countess. Here is another Instance of his Bounty, which relates to us in particular. Those Birds who are detri-

mental to us, and those with whose Existence we can easily dispense, are the Species who multiply the least. On the contrary, those whose Flesh is most salutary, and whose Eggs afford the best Nourishment, are fruitful to a Prodigy. The Hen alone is a Treasure for Man, and daily makes him a Present extremely valuable. If she sometimes ceases to furnish out her Master's Table, 'tis only that she may the better recruit his Poultry; and for her Services, so frequently repeated she demands nothing but the most insignificant Remains of his Barn and Table. It would be Ingratitude not to be sensible of the Merit of such a Domestic. But let us leave this Article, and return to the Birds.

I suppose the Eggs hatch'd; and now
 The Rearing the Young makes its Appearance: With
 of the Young. what a new Weight of Cares are the Pa-
 rents charged, 'till the Brood are capable
 of subsisting without them! They are sensible, 'till that
 Period, what it is to have the Care of a Family. Provi-
 sion must be prepared for eight instead of two. The
 Linnet and the Nightingale labour then like the rest.
 Adieu to Music, 'tis no longer a Season for Singing: Or,
 at least, they indulge it with the less Frequency. They
 are pressed by Necessity, and constantly in quest of Pro-
 visions, sometimes one, sometimes the other, and some-
 times both together. They are up before the Sun, they
 distribute the Food with great Equality, giving each its
 Portion in its Turn, and never feeding one Bird twice.
 This Tenderneſs of the Mothers for their Young operates
 to a Degree that even changes their natural Disposition,
 and new Duties introduce new Inclinations. 'Tis not only
 incumbent on them to nourish; they must likewise watch,
 defend, and forecast; they must oppose the Enemy, and
 hazard their own Persons in each Encounter. Follow a
 Hen when she becomes the Parent of a Family, and you will
 see she is no longer the same Creature. Tenderneſs chan-
 ges her Humours, and corrects her Imperfection, she was
 formerly ravenous and insatiable, but at present, she
 no longer resembles herself. Does she find a Grain of
 Corn, a Crumb of Bread, or even something more confi-
 derable in quality, and capable of being divided; she ne-
 ver touches it herself, but gives Intelligence to her Troop,
 by

by a Note of Invitation they all understand: They run to her with great Expedition, and the discovered Food is only for their Use, whilst the Mother confines herself to the greatest Moderation in her own Meals. This Mother, naturally timorous, and who before knew nothing but Flight, is a Heroine at the Head of a Troop of Chickens; she is no longer acquainted with Danger, but springs to the very Eyes of the stoutest Dog, and is inspired with so much Courage by her new Dignity, that she would venture to encounter a Lion.

I lately saw one of these Creatures in another Situation, no less entertaining. I gave Directions to have some Eggs of a Duck put under her, and they were hatched to my Wish. The Young, when they quitted the Shell, had not the Form of her ordinary Brood: but she still fancied herself their Parent, and, for that Reason, was extremely pleased with them, and tended them as her own, with the greatest Fidelity. She gathered them under her Wings, cherished them with Warmth, and led them up and down, with all the Authority and Privilege of a Mother. She had always been perfectly well respected and obeyed by the whole Brood; but unfortunately for her Honour, a Brook appeared in the Way, and all the little Ducks were immediately in the Water. She was in a wonderful Perplexity; she followed them with her Eyes along the Bank, gave them Counsel, reproached them for their Rashness, called loud for Assistance, and uttered her Complaints to all around her. She returned to the Stream, and renewed her Call to these imprudent Creatures. But the Ducklings, transported to find themselves in their proper Element, from that Moment discharged her of all future Care; and as they had then acquired Strength, they returned to her no more.

Prior. Her Ladyship will permit me to interrupt her a Moment, and ask the Chevalier in what School these Ducklings had learned that Water was their Element? They certainly had not this Information from the Hen.

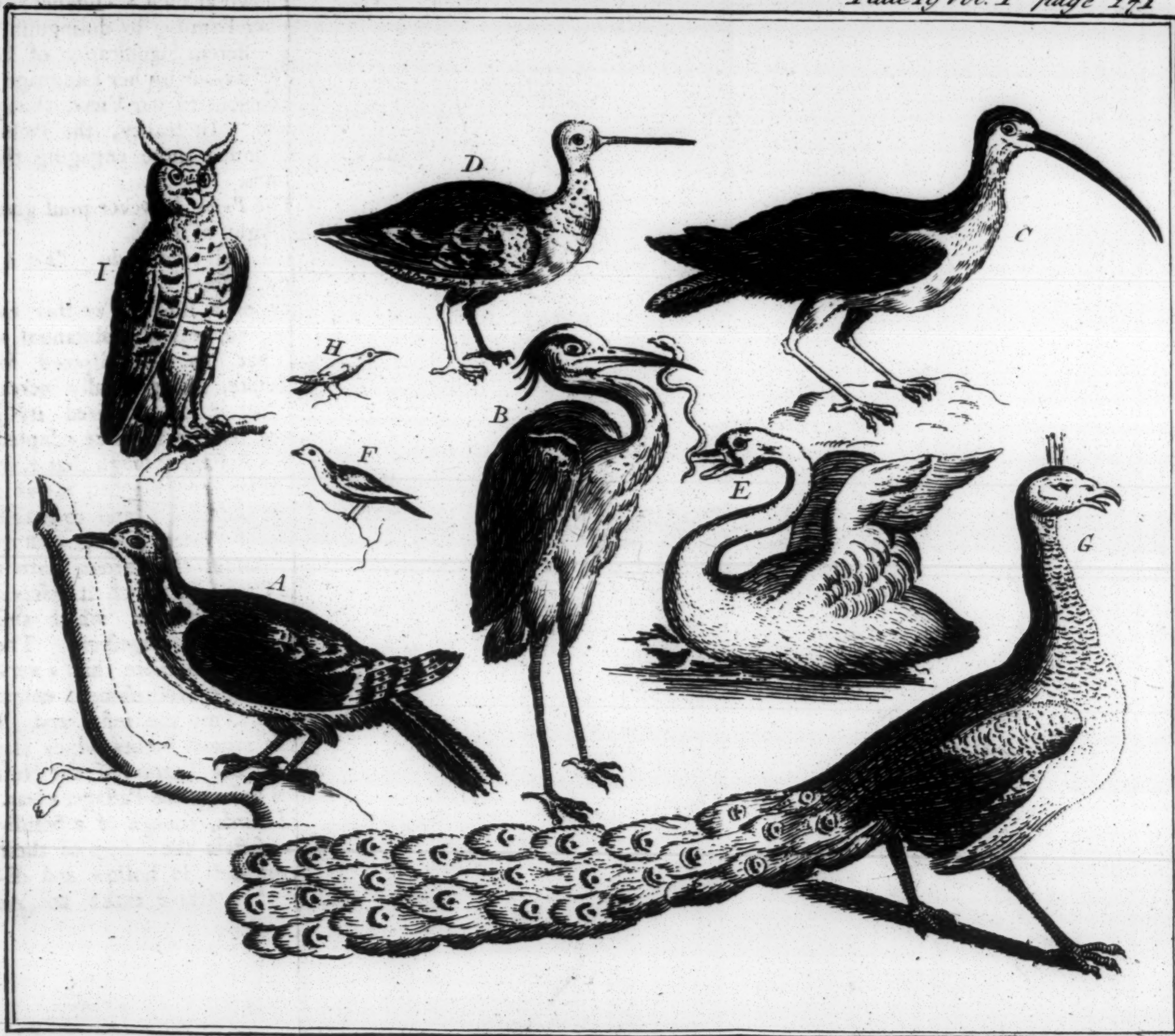
Chev. I conceive it. This Propensity to the Water is implanted in the very Nature of the Duck. 'Tis the Work of the Deity.

Prior. One cannot, in such an Instance, mistake the
I Impression

Impression of the Creator, which anticipates all Lessons, and corrects Education itself.

Countess. I must give the *Chevalier* another Instance of a Mother's Anxiety, to which I have frequently been a Witness. When the Turkey Hen appears at the Head of her Young, she is sometimes heard to send forth such a mournful Cry, the Cause and Intention of which are unknown. The Brood immediately squat under Bushes, Grass, or whatever else presents itself for their Purpose. They intirely disappear; or if they have not a sufficient Covering, they stretch themselves on the Ground, and lye as if they were dead. They are seen to continue in this Posture, without the least Motion, a whole Quarter of an Hour, and sometimes a much longer Time. In the mean while, the Mother directs her View upwards with an Air of Fear and Confusion; she redoubles her Sighs, and repeats the Cry that laid all the Young prostrate. Those who observe the Disorder of this Parent, and her anxious Attention, look up into the Air to discover the Cause; and at last perceive a dark Point which they can hardly distinguish, floating under the Clouds. This is a Bird of Prey, whose Distance withdraws him from our View, but who cannot escape either the Vigilance or Penetration of our Mistress of the Family. This occasions her Fears, and alarms the whole Tribe. I have seen one of these Creatures continue in this Agitation, and her Young in a manner rivetted to the Ground, for the Space of four Hours successively, whilst the Bird whirled about, ascended and darted down over their Heads. But if he at length disappears, the Mother changes her Note, and utters another Cry that revives all her Brood; they run to her, they flutter their Wings, and tender her their Caresses; they have a hundred Things to tell her, and undoubtedly relate all the Dangers to which they have been exposed. They bestow their Imprecations on the vile Bird. — But the Subject grows too sportive to engage your Attention any longer.

Prior. Every Circumstance of your Ladyship's Account is altogether worthy of Observation. Who could make this Mother acquainted with an Enemy who never injured her; and as yet, had not committed any Act of Hostility



A. The Woodpecker darting his Tongue into the Cavity of a Branch B. The Heron C. The Curlew
D. The Woodcock E. The Swan F. The Nightingale G. The Peacock H. The humming bird I. The Owl.

lity in the Country? And how could she be able to discover this unknown at such a Distance? What Instructions had she given her Family, to distinguish, according to the Occasion, the different Signification of her Cries; and to regulate their Behaviour by her Language? All these Wonders are daily obvious to our View, though we treat them with Inattention. In reality, the Picture her Ladyship has drawn, is much more engaging than some very serious Dissertations.

Countess. The *Prior* however must give us one, on the Structure and Flight of Birds.

Prior. That I shall readily do. 'Tis a Subject perfectly agreeable to my Taste.

The * Body of a Bird is neither extremely massive, nor equally substantial in all its Parts; but 'tis well disposed for Flight, sharp before, and gradually increasing in Bulk, 'till it has acquired its just Dimensions. Such a Structure renders it more adapted to cut the Air, and make itself a Passage through that Element.

The Form of a Bird.

To qualify it for long Flights, in which Provisions are not always to be obtained; and to enable it to pass away the many Hours of Winter Nights without eating, Nature has supplied it, under the Throat, with a Bag called the Crop, in which it reserves its Meat. The † Fluid in which this swims facilitates its first Digestion. The Gizzard, into which no more than a very small Quantity of the Nourishment enters at one Time, performs the rest, and frequently by the Aid of such little rugged Stones which the Bird swallows, in order to break the Texture of the Nutriment the better, and perhaps to keep the Passages clear.

The Crop.

The Gizzard.

The Bones of Birds, though of a Solidity sufficient to sustain the System of their Body, are nevertheless so hollow and diminutive, that they scarce make any Addition to the Weight of their Flesh.

The Bones.

* Derham Theol. Phys. l. vii.

† Willughby's Ornitholog. l. i.

The whole Plumage is artfully formed and distributed, as well to sustain the Bird as to defend it from the Injuries of the Air. The Quill of the Feather is, at the same Time, firm and light. It is firm, in order to cleave the Air with a proper Force: It is light and hollow, in Proportion to its Growth, that the Bird may not be whelmed downwards instead of being raised aloft. In a Word, this hollow Quill, or we may rather represent it as filled with a Body of Air more dilated and lighter than the external Parts of that Element, possesses a great deal of Surface with little Gravity, which places the Bird almost in Equilibrium with the Air. The Feathers are inverted behind, and laid one over another in a regular Order. That Part of them which is next the Body, is furnished with a warm and soft Down; and that next the Air is arrayed with a double Beard, in two Ranks, and longer at one End than at the other. These Beards are a Row of little flat and thin Plates or Laminæ, disposed and inserted in a Line, as perfect as if their Extremities had been cut with a Pair of Scissars. Each of these Laminæ is itself a Quill or Basis, which sustains two new Ranks, of a Minuteness that almost renders them invisible, and which exactly closes up all the little Intervals through which the Air might be insinuated. The Feathers are likewise disposed in such a Manner that the Range of the little Beards of the one, slides, plays, and discovers itself, more or less, under the great Beards of the other Feather that lyes over it. A new Rank of lesser Feathers serves as a Covering to the Quills of the larger. The Air is excluded from every Part; by which means the Impulse of the Feathers on that Fluid becomes very strong and efficacious.

But as this Oeconomy, so necessary in its Constitution, might be frequently incommoded by Rains, the Author of Nature has furnished Birds with an Expedient that renders their Feathers as impenetrable to the Water as they are by their Structure to the Air. * All Birds have a Bag filled with Oil, and shaped like a Nipple, the Situation of which is at the Extremity of their Body. This Nipple

* Willughby's Ornitholog. lib. i.

has several little Apertures, and when the Bird finds her Feathers dry, soiled, discontinued by Gaps, or ready to be moistened, she presses this Nipple with her Bill, and forces out an Oil, or fat Humour reserved in the Glands; and then drawing her Bill over the greatest Part of her Feathers successively, oils and dresses them, gives them a Lustre, and fills up all the Vacancies with this viscous Matter; after which, the Water only slides over the Bird, and finds all the Avenues to her Body perfectly closed. Our Poultry who live under a Covert have a less Quantity of this Liquor than Birds who inhabit the open Air; for which Reason, a Hen, when she is wet, makes a ridiculous Figure: On the contrary, Swans, Geese, Ducks, Moorhens, and all Birds destined to live on the Water, have their Feathers dressed with Oil from their very Birth. Their Magazine contains a Provision of this Fluid, proportionable to the Necessity of its Consumption, which is continually returning; their very Flesh contracts the Flavour of it, and every one may observe that the Care of oiling their Feathers is their constant Employment.

If there is so much Wisdom in the Structure of the Feathers, there is no less in The Wings. the Play of the Wings and Tail, in order to traverse the Air. Nothing can be better placed than the Wings; they form on each Side two Levers which keep the Body in a just Poise; at the same Time they perform the Function of Oars, which, by bearing on the Element that resists them, advance the Body in a contrary Direction.

The Tail is a Counterpoise to the Head and Neck, and serves the Bird instead of a The Tail. Rudder, whilst he rows with his Wings; but this Rudder is not only instrumental in preserving the Equilibrium of the Flight; it likewise enables the Bird to rise, descend, and turn where he pleases; for as soon as the Tail is directed to one Point, the Head turns to the opposite Quarter.

Chevalier. Though I don't comprehend how Birds perform their Flight, I am of Opinion, it is not impracticable for Man to imitate them; and the Birds instruct him in the Method he ought to observe.

Prior. 'Tis certain that we have the Principle of Motion in our Legs and Arms; we likewise have, in the Feathers of Birds, and in our Linen Cloth and Oil, Materials of a seeming Fitness to form Wings, capable both of striking and impelling the Air, without being penetrated by it. The Birds supply us with a Model of the Action, and at first View it seems to be an Invention naturally presented to us, and which a small Effort, or a few Reflexions, would suffice to make us acquire in Perfection; but I believe God, in consequence of his providential Care of Mankind, has opposed an insuperable Impediment in the Way; so that this Attempt, which has been frequently repeated, hath always proved unsuccessful. The Art of Flying would be the greatest Calamity that could happen to Society.

Chevalier. On the contrary, Sir, I should think this Invention would save us Abundance of Labour. We should be sooner acquainted with what we are desirous of knowing; and if we had once found out a small Machine, could soon build a larger. We should not only traverse the Air ourselves, but might likewise convey Cargoes of Merchandize through that Element. By this means Commerce —

Prior. You have a charming Penetration, *Chevalier*, and are the best in the World at guessing the Advantages we might receive from this Invention; but these Advantages would not countervail the Disorders that would be introduced.

Count. This is certain, that were Men capable of Flying, no Avenue could be inaccessible to Vengeance and inordinate Desires. The Habitations of Mankind would be so many Theatres of Murder and Robbery. What Precautions could we take against an Enemy, who would be capacitated to surprise us both by Day and Night? How should we preserve our Money, our Furniture and Fruits from the Avidity of a Set of Plunderers, furnished with good Arms to force open our Houses, and as good Wings to carry off their Booty, and elude our Pursuit? This Sort of Trade would be the Refuge of every indigent and impious Person.

Prior.

Prior. I may add to this, that the Art we are now mentioning would intirely change the Face of Nature; we should be compelled to abandon our Cities and the Country, and to bury ourselves in subterraneous Caves, or imitate Eagles and other Birds of Prey; we should retire like them to inaccessible Rocks, and craggy Mountains, from whence we should, from time to time, fall down upon the Fruits and Animals that accommodate our Necessities; and from the Plain we should immediately soar up to our Dens and Charnel Rooms.

Countess. Ah! Gentlemen, you make me tremble at your Art of Flying; and I bestow before-hand my Imprecations at the Person, who shall attempt to make it practicable. Let me hear no more of Dens and Charnel Rooms. Do you see, *Chevalier*, what you expose us to with your Inventions?

Count. Make yourself easy on this Head. We need not be under any Apprehensions about the Art of Flying, which indeed is an absolute Impossibility; Nature herself has formed an Obstacle against it, that is in some Measure made invincible, by the exceeding Disproportion between the Weight of the Air and an human Body. The hollow Machine that one must imagine capable of sustaining the Body of a Man, and placing it in an equal Balance with the Air, would be so immoderately large and cumbersome, that learned Men have judged the Management and Use of it to be altogether impracticable, and as much forbidden to Man as the perpetual Motion.

Countess. Are you disposed, Gentlemen, to resume the Subject of Birds to-morrow.

Count. There is no Want of Variety. The Difficulty lyes in confining ourselves to a due Limitation. What shall be the Articles of our Entertainment?

Prior. Let each chuse what is most agreeable to his Taste, and serve it up as a Country Collation.

Chevalier. If the *Prior* pleases to be my Security, I will acquit myself like the rest.

Countess. For my Part, Gentlemen, I promise you
'before-hand a Bird found in no Place, but *America*;
'tis the least and most beautiful of all Birds, and
should it not be sufficient for you, I will make you
amends with an Ostrich.

The End of the tenth DIALOGUE.

DIALOGUE XI.

The COUNT and COUNTESS.
The PRIOR, and
The CHEVALIER.

Chevalier. **Y**esterday in the Evening I slipt into his Lordship's Closet, where I found *Willughby's* Book lying open on the Table. I ran over all the different Species of Birds, who are there finely delineated and coloured after the Life, and my Thoughts turned on nothing else all the Night; but I was particularly surpris'd at the immoderate Bill and Legs I observed in some, whilst others had a very short Beak; and were so contracted in their Legs, that the Extremities of their Claws were hardly discernible. After all, both the one and the other are only ordained to expatiate in the Air, and seek their Food. For what Reason then is there such a prodigious Variety in their Wings, their Bills, their Claws, and every other Part? Are all these different Forms no more than the Play of Nature; or do they tend to any particular Purpose?

Count. The Inequality you observe in the Bills of these Creatures, does not correspond with the Differences you discover in the Noses of Men; for in these, an Inch more or less constitutes all the Diversity between the longest and shortest. In every other Particular

the Structure and Use are the same; whereas, in the various Species of Animals, the Bill, the Talons, the Dimensions of their Wings, and generally all the Parts of their Bodies are calculated for the Accommodation of their Wants. They are a set of Implements proportioned to the Nature of their Labours, and Manner of Life. A few Instances will be sufficient to justify my Sentiments. Sparrows and the Generality of small Birds, are supported by the little Grains they find either in our Houses, or the Country. They have no Efforts to make, in order to obtain their Food, or break it in Pieces, and therefore have a small Bill; their Neck and Legs are very short, and suffice their Purpose. But the Case is different,

The Woodcock.

with respect to the Woodcock, the Snipe, the Curlew, and a Variety of others; who seek their Aliment very deep in the Earth, and in Slime, from whence they draw the little Shell-fish, and Worms that sustain them. Nature has supplied these Creatures with a very long Neck and Bill; and with these Instruments they dig, and search, and want for nothing.

The Woodpecker.

The Woodpecker, who lives in a very different Manner, is therefore as different in the Structure of his Body. His Bill is very long, and of an extraordinary Strength and Solidity; his Tongue is sharp, extremely long, and beside that, it is armed with little Points, and always covered with Grew towards its Extremity. He has short Legs, two Talons before, and as many behind, and all very crooked. All this Equipage relates to its Manner of living, and obtaining its Prey. This Bird derives its Subsistence from little Worms, or Insects, who live in the Heart of certain Branches, and most commonly under the Bark of old Wood. 'Tis very usual to find the Retreat of these minute Animals, sunk very deep in large Billets, under the Bark, which easily peels off. The Woodpecker should be provided with hooked Claws, in order to grasp the Branches where he fastens. Long Legs would be useless to him, for his Attainment of what lyes under the Bark; but a strong and pointed Bill was necessary for him, to find out by darting it up and down the Branches, what Places are void and rotten. He stops where the Branch sounds hollow,

low, and with his Bill shatters the Bark and Wood ; after which, he injects his Bill into the Orifice he has made, and sends forth a loud Cry, or a kind of whistling Sound, into the Cavity of the Tree, in order to alarm the Insects who sleep there, and put them in Motion. He then darts his Tongue into the Aperture, and by the Assistance of the small Points, which rise out of that Tongue, and the Glee which rolls over it, he draws out all the little Animals he finds there, and regales himself with the Prey.

The Heron quite contrary to the Woodpecker, is mounted aloft, his Legs and Thighs are very long, and entirely destitute of Plumage ; he has a great Length of Neck, and an enormous Bill, very sharp, and jagged at the Extremity. What Reasons can be assigned for a Figure, which at first seems so extravagant ? The Heron feeds on Frogs, little Shell-fish, as well as the other Fish he finds in Fens, or near the Shores of Rivers and the Sea. He wants no Feathers on his Thighs, to enable him to march through the Water and Slime ; but very tall Legs are exceeding useful to him, as they qualify him for running, more or less in the Water, along the Shores, where the Fish usually resort for their Food. A long Neck and Bill make him capable of pursuing and seizing his Prey at a considerable Distance ; the crooked Turn and Jags of his Bill, that bend like Hooks, enable him to detain the Fish, who would otherwise slide away, and escape him. In a Word, his large Wings, that may seem incommodious to an Animal of so small a Body as a Heron, are infinitely assistant to him in making great Movements in the Air, and conveying weighty Burdens to his Nest, which is sometimes seated one or two Leagues from the Place where he fishes. A Friend of mine, who has an Estate in *Abbeville*, bounded by a little River plentifully stored with Eels, saw a Heron one Day carry off one of the largest of those Creatures, into his Hernery, in spite of all the Efforts and Undulations of the Eel to oppose his Flight. What we have observed of the Heron, is applicable to several other Species which resemble him.

Countess. This is the first Time I have heard any Observations made on the Use of these Bills, which till now seemed a little extravagant to me. But I am sensible the

Imperfection belongs to myself, and all our Censures of Nature are really so many Confessions of our own Ignorance. I don't know, for Instance, wherein the prodigious Bill of a Stork can be serviceable; but shall never prevail on myself to cavil at it.

The Stork. She digs into the Earth with it, for Serpents and Adders, which she afterwards conveys to her Young, to whom the Poison of these Animals is perfectly inoffensive.

Countess. Its just Proportion is now very evident, and in Reasoning on this Subject, methinks I shall be able to guess, why the Swans we see on the Canal below, have a long Neck, and a broad Bill. Swans, Geese, and Ducks are perpetually raking at the Bottom of the Water, because they there find some

of the little Vermin, or Worms you spoke of the other Day. As they are always swimming without being able to sink, they ought to have a long Neck capable of extending to the Bottom; and therefore should they not, quite contrary to other Birds, have a very broad Bill, to take in at one Time a larger Quantity of Slime and Gravel, and seize all the Worms found there, by separating them from the other Matter, in which they are found? I even suspect, that the upper Part of their Bill is pierced, in order to discharge the Water through that Opening, and that they may only swallow the Fish, or Insect they have taken. Instead of those crooked Talons, with which Birds who feed on Flesh, are able to seize and turn their Prey, and fasten on the Branches where they settle; Swans, Geese, and Ducks have flat Feet, or large Paws, accommodated with Films, or Skins, which they extend in the Form of Fins, and with which they impel the Water one Way, that they may advance another. The *Prior* sees I am mighty sagacious. All this is very difficult to be explained.

Prior. The Merit of Natural Philosophers, Madam, among whom we rank your Ladyship at present, does not always consist in solving Difficulties; but rather in turning their Eyes on Points unobserved by others, and commonly treated with Contempt. Nothing is more unusual than to meet with People who think and reflect.

Countess,

Countess. We Women are discharged from that Care, and it seems the Men do not usually expect Thought from us. Among them, a little shining Liveliness supplies us with every necessary Accomplishment.

Prior. I must confess their Indulgence is very great in this Particular, and your Ladyship has no Occasion to complain of them.

Countess. On the contrary, permit me to tell you, we have infinite Reason to complain of such a Proceeding, and receive irreparable Injury from the Misapplication of this Indulgence; 'tis this which renders us vain, indolent, incapable of Elevation, ignorant, unpenetrating, and irresolute; and we may be certain, that the Men, by the Conduct they observe with respect to us, labour to form in our Minds all those Imperfections for which they reproach us. Is it not one of the Maxims of their Politeness, to entertain us with nothing but Trifles? In the Language we receive from them, and the Assiduities with which they treat us, it is evident, they regard us either as Children, or Idols. Their Conversation with us, is always confined to Modes, or Play, and a certain polite Jargon. 'Tis a kind of Miracle, when any one of our Sex preserves her Understanding from the common Wreck, and discovers a little Justness and Solidity. We sustain no great Loss, by not being instructed in the ancient Languages, and I have a perfect Indifference for those learned Researches, and gloomy Sciences, which by an immoderate Application to them, make us useless to Society: But our Fate is to be lamented, in that the Generality of us have no solid Knowledge of our Religion; no Acquaintance with the History of Mankind, which is also the History of the Heart of Man; and scarce any Idea of the Works of the Deity. For my Part, I assure you, the People I have met with seem'd in a Combination to ruin the little good Sense that might be discoverable in me. The Count was the first who did me the Justice to believe I had my Share of Reason as well as the rest. It was evident by the Conversation with which he entertained me, that he judg'd me capable of Thinking; and is it not doing me Honour to believe me not unworthy to hear Discourses on Things that every where present themselves to our View, or are most essential to Life; to know why a Tree rises in

in such a Shape; to be acquainted with the Cultivations of the Earth, and the Qualities of a Plant that springs at our Feet, when we are walking? Since his Lordship has led me into a Habit of thinking, and employing myself to Advantage, my Country Seat has seem'd to me an earthly Paradise. I enjoy Beauties and Treasures with which Nature abounds, but which were so many lost Treasures to me, when I was not so much as acquainted with their Names.

Count. Your Complaints against our Sex are, without doubt, very justly founded. But I cannot say the same with respect to your Confession of the disagreeable Qualities of the Ladies. There are certainly great Numbers of them, in whom good Sense is the prevailing Accomplishment; and whose Understanding is equally judicious and delicate; whether they owe this Solidity to a happy Cultivation, or whether the Fineness of their Genius rectifies the Defects of a weak Education. But whilst you are lamenting the Ladies Fate, and I am offering an Apology for them, we take no Notice that the poor *Chevalier* is half asleep.

Countess. He is not to be blamed. I have promised him a Couple of foreign Birds, and instead of them give him a Lecture in Morality. What I am now going, Sir, to acquaint you with, I had from a Merchant at *St. Malo*, a great Traveller, and one who had contracted with my Lord, to furnish his Cabinet with foreign Curiosities. Six Months ago he paid us a Visit, at his Return from a new Voyage he had made to *America*, and the Coasts of *Guiney*. He presented me with two Humming Birds, and as many Eggs of an Ostrich, and informed us of several entertaining Particulars, relating to these Creatures.

The * Humming Bird is peculiar to *America*, and may pass for a little Miracle of Nature, as well for its Beauty, as its Manner of living, and exceeding Smallness. It is not bigger than a large Fly, but is decked with such a beautiful Plumage, that its Neck and Wings have all the lucid Colours of the Rainbow. His Neck is

The Humming Bird.

* Biblioth. univ. & hist. Anno 1687. Observ. cur. Tom. II.

tinged

tinged with such a glowing Red, that one might imagine it to be a Ruby. The Belly, and nether Part of the Wings, are as yellow as Gold; and the Thighs appear green as an Emerald: The Feet and Bill are black, and polished like Ebony. The Eyes display two oval Diamonds, and resemble the Colour of polished Steel. The Head is green, intermixed with Gold of a surprising Lustre. A little Tuft rises on the Heads of the Males, and is an Assemblage of all the Colours that shine in the other Parts of the Body. These Birds fly so swiftly, that they are rather heard than seen. We are told, that Dews and the Juices of Flowers are their Food, which they extract with their little Tongue, whose Length exceeds that of their Bill, and serves them instead of a Trunk, which they contract and sheath in their Bill. This Bill, which is not larger than a fine Needle, makes them formidable to the great Birds called *Grosbecks*, who endeavour to surprise the Young of the Humming Bird in their Nest; but when the Dam makes her Appearance, the Invader flies off, and cries with all his Might, because he is sensible what an Enemy he has to contend with. The Humming Bird pursues him close, and if he can come up with him, fastens himself with his little Talons, under the Wing of his Enemy, and pierces him with his pointed Beak, till he has made him incapable of Combat. You may see in that Box two of these pretty Birds, who, though they have been sufficiently dried, still retain a considerable Part of their rich Colours. You see they are hung, by their little Feet, to a small Ring of Gold in the Form of Pendants, because the Ladies of *Mexico*, apply them to that Use; and it must be confessed, no Pearls can equal them in Beauty.

Chevalier. These are Birds in Miniature indeed. Your Butterflies can't shew more amiable Colours. But, Madam, I shall be glad to know if this charming Scent be natural to them.

Countess. Several People believe it proceeds from the Juices of the Flowers that nourish them; but my Merchant is of Opinion, that a little Ambergrease, or fragrant Gum is wrapp'd in the Cotton, with which they are filled, for their better Preservation.

Count,

Count. The best expedient to secure them from being injured by Mites, and other Insects, is to lodge them in Caskets composed of several Glass Plates, whose Extremities are neatly joined with Bandages of Parchment, that have either been drenched in a bitter Gum, or are filled with Glass reduced to Powder.

Chevalier. This indeed will prevent them from being penetrated by the Teeth, and Piercers of Insects: But her Ladyship, if I am not mistaken, has promised us the History of the Ostrich.

Countess. This is one of the largest Birds* in the World, and they are more numerous in *Africa*, than in any other Country: Her Head rises to the Height of a Man on Horseback, and is sometimes more lofty: Her Head and Bill resemble those of a Duck: Her Neck is like a Swan's, but greatly exceeds it in Length: Her Body bears some Similitude to the Camel's, having, like that Creature, a long Neck, and a rising Back. The two Wings of the Ostrich are very strong, but too short to raise her from the Ground, and † only serve her instead of Sails, or Oars, to enable her to cut through, and impel the Air, and add an extraordinary Swiftneſs to her Motion, when she runs. She has the Legs and Thighs of an Heron, Allowance being made for the different Proportion: Each Foot rests on three Claws, armed with Horn, to facilitate her march.

Her Eggs are as big as an Infant's Head: The Shell has Veins drawn over its Surface, like Marble, is very shining, and perfectly well polished. I will shew you a Couple that were presented to me. 'Tis the Custom of the Ostrich to hide them inconsiderately in the Sand; and, ‡ to leave, as we are told, the Care of hatching them to the Sun. This Disposition, that seems to manifest so much Disregard to her Young, has acquir'd her no extraordinary Reputation. In all Countries where she is known, when they would speak of a Mother who has little Tenderness for her Children, they compare her to the Ostrich.

* Willughby's Ornithol. lib. xii.

† Diod. Sicul. lib. iii.

‡ Job xxxix. 14, 16. Lamentations of Jerem. c. iv. ver. 3.





Some * Travellers, as my Merchant inform'd me, have endeavour'd to excuse her and affirm, she is careful to leave a Quantity of Worms near her Eggs, that her Young may find proper Nourishment when they issue from the Shell. Some have pretended to discover an admirable Discernment in the Ostrich, which † inclines her carefully to warm those Eggs, which are to be prolific, and to neglect the rest, that they may serve for Nourishment to her Young, when they come to be hatched. But this has a considerable Cast of the Fable; and it must be acknowledged, that the Prudence of other Animals is not visible in the Ostrich. She leaves her Eggs in the Sand, liable to be crush'd by the Feet of Passengers, which is no extraordinary Instance of Precaution: But another Circumstance, which has given Birth to the Remark, that her Conduct is not regulated by the Brain, is this: When she is pursued by the Hunters, she runs to hide her Head, and particularly her Eyes, behind a Tree; all the rest of her large Body is expos'd to View, but as she no longer sees the Hunter, she imagines that sufficient, and believes she has nothing to apprehend.

Chevalier. Is it true, my Lord, that Ostriches eat and digest Iron, as I have heard?

Count. It is certain, they swallow small Pieces of that Metal, as other Birds take down Pebble Stones, but they are not digested by these Animals; and if they swallow them, 'tis not to derive any Nourishment from them, but only to bruise and grind the Food in their Stomach, to moderate the Operation of an excessive Heat, and by its Weight open the Passages into the Intestines.

Countess. Before we leave the Ostrich, who has had but an indifferent Character from us, let us relate all the advantageous Things that we can say in her Favour. She furnishes us with most lovely Feathers, very broad and long, some white, others black, but which are tinged by Art with all the Variety of Colours: They are placed as Ornaments on the Testers of Beds, the Canopies of great Men, and the Caps of Children: They adorn the Hats of Gentlemen, and furnish the Ladies with very pretty

* Derham, Theol. Phys. l. iv. c. 15. & lib. vii. c. 4.

† Ælian. Hist. lib. xiv. c. 7. & lib. iv. c. 37.

Fans: They add Height to the Stature of Tragedians, and it must be confessed, the Theatrical Heroes would lose a considerable Part of their Grandeur, were they divested of the Ostriches Plumes.

Gentlemen, I have presented you with the least and largest of all Birds. You may fix your Choice between these two Extremes; the Field is very spacious.

Prior. 'Tis so spacious that I am intirely lost, and own myself confounded by the very Abundance I discovered.

Countess. Since all Subjects are alike to you, let me appoint each his Part. The *Prior*, as he is a Man of good Taste, ought to charge himself with the Recommendation of Birds valuable either for the Melody of their Notes, or the Beauty of their Plumage. But he shall be released from this Task, when he has favoured us with a few Words on the Nightingale and Peacock; and he will hardly complain of the Part allotted him. His Lordship, as he is a great Sportsman, should present us with Birds of Prey; and the *Chevalier* has told me, in a Whisper, that he has reserved the Birds of Passage for our Entertainment. In my Opinion, these are all the Species, unless any one has an Inclination to add the Bat and Owl.

Prior. Of all the Classes of Birds, none prove more agreeable Companions to Man, than those who enjoy the Gift of Harmony and Speech. But what Pleasures soever they administer, they are all Foils to the Nightingale, who alone charms us as much as the whole Band of the other Species. After we have listened to the most melodious Symphony, we are agreeably surpris'd to hear an excellent Violin, unaccompanied by any other Instrument. Let Signior *Geminiani*, in the midst of a fine Concert, begin a Solo, and enchant us with those Strokes of his Bow, that so wonderfully distinguish him: Every Ear is all Attention; we admire the extraordinary Force with which he draws and modulates his Tones, nor are we less affected with the exceeding Softness inseparable from them: He always knows how to diversify his Play; and his Performance receives an infinite Contrast from what preceded, and communicates Agreeableness and Value to the Airs that follow. He leads the Ear from Wonder to Wonder. All the Audience is transported
with

with the Charms of the Harmony; and the most scrupulous Judges perceive throughout the whole a Multitude and Justness of Proportions that entertain them, with an entire Orchestre in a single Instrument. 'Tis the very same in a Concert of Birds: After we have heard a full Chorus celebrate the Author of Nature, and proclaim the Bounties of him who sustains them, 'tis an agreeable Novelty, in the Evening to hear the Nightingale begin to sing by himself, and continue his Notes till the Night be far advanced. One would imagine him sensible of the Merit of his Accomplishments; and that it is in Complaisance to Man, as well as for his own Satisfaction, that he is pleased to sing when all the rest are silent. Nothing animates him so much as the Stillness of Nature. He then composes and executes all his Harmony. He rises from Solemnity to Sprightliness of Sound, and warbles from a serious Song to a more sportive Transition, after which he softens the lightest Quavers and Divisions into the most languishing and plaintive Strains, and at last returns to the natural Chearfulness of his Melody. One is often tempted to gain a View of the amiable Musician who so obligingly amuses us each Morn and Evening. We search for him and still he lyes concealed. A great Genius has its capricious Peculiarities. When we only hear him, our Imagination is apt to lend him a stately Shape. We suppose he ought to have a vigorous Breast and indefatigable Organs, to furnish out and sustain, without languishing, such a Strength and Gracefulness of Sound; such multiplied and striking Proportions, such a prodigious Variety of Music; and yet we find it the Throat of a very little Bird, who, without a Master, Study, or Preparation, accomplishes all these Wonders.

What the Nightingale is to the Ear, the Peacock is to the Eye. It must be granted, that the Cock, the Wild-Duck, and the King's Fisher, the Goldfinch, the Parrot, and the Pheasant, with a Variety of other Birds, are very finely array'd, and we are delighted with the Consideration of their Ornaments, and the elegant Taste of their different Vestures, but when the Peacock appears, every Eye is allured. The Air of his Head; the easy Turn of his Shape; the blended Colours of his Body; the

the Eyes and clouded Spots of his Tail; the Gold and Azure that shine in every Part; the Round of Plumage he draws after him with so much Pomp; his Aspect full of Dignity, and the very Attention with which he unfolds his Ornaments to the Spectators, whom Curiosity assembles around him, have a singular and ravishing Effect. This Bird alone is a noble Spectacle; but would you imagine he had any unpleasing Deficiencies? However, this is the Fatality of the Peacock; he dissatisfies all his Beholders: He can neither talk nor sing; his Language is shocking, 'tis a Cry capable of inspiring one with Horror; whereas the Linnet, the Linnæa, the Thistlefinch, and the Parrot, with all the modestest and most simple Accomplishments, live with us fifteen Years or more, without giving us a Moment's Disgust; they are Creatures of Understanding and good Behaviour, and that is saying every Thing to their Advantage. A pompous Exterior is a Qualification the least necessary to render Society agreeable, and of a long Duration.

I have expatiated, perhaps, too much on the Articles of Adjustments and Music; and these Particulars have but little Correspondence with my Profession. It will be more graceful for his Lordship to entertain us with Falconry, for that is the proper Recreation of a Gentleman.

Count. This Sport is one of the noblest, and frequently proves one of the most profitable Pleasures. Mankind have discovered the Secret of making even the voracious Quality of Birds advantageous, either by employing them against those called Malignants, because they are always warring with the most timorous Species, (of this destructive Class are Kites and Ravens, who attack only Pigeons and Chickens) or else by employing them against those Birds whose Flesh affords the most exquisite Relish, but who live at a great Distance from us; such are the Partridge and Pheasant. For these different Sports, the Falcon, the Gerfalcon, the Lanner, the Saker, the Merlin, the Sparhawk, and Goshawk are much esteemed: But in general, the Falcon, and Hawk are more serviceable, and used with greater Frequency than the rest. The Falcon and all those I named first, are in extraordinary Repute, and trained up to various Flights, some of which are pointed against the
Heron

Heron, others against the Kite, the Curlew, and the Owl. But these Pleasures are very expensive, and only fit for Kings or Princes. The Hawk is useful in low Flights; he is sagacious and very dextrous in attacking the Partridge, and is sure to furnish the Larder with excellent Game. A prudent Gentleman leaves the Falcon to Princes, and contents himself with the Hawk.

The Manner of training them up, and employing them in the Field, is very agreeable. Those who are brought up for this Exercise are either *Nias* or *Hagard* Birds.

The Manner
of training up a
Bird of Prey.

Those are called *Nias*, who have been taken in the Nest, and *Hagards* are those who have enjoyed the Liberty before they were caught. These last are tamed with more Difficulty; but Patience and Dexterity succeed in that Particular, and, in Terms of Falconry make them tractable and fit for the Fray. When they are too wild, they are neither fed, nor suffered to sleep, for three or four Days, and as many Nights, and are never left alone; by which means they grow familiar with the Falconer, and are obedient to all his Commands. His principal Care is to accustom them to settle on his Fist; to spring when he throws them off; to know his Voice, his Singing, or any other Signal he gives them; and to return to Order on his Fist. At first they are tyed with a String, of about thirty Fathoms in Length, to prevent them from flying away when they are *reclaimed*; and they are not freed from this Confinement till they are compleatly disciplined, and always return at the Recal. To accomplish this, the Bird must be lured; and I shall now acquaint you with the Nature of a *Lure*.

A *Lure* is a Piece of red Stuff or Wood, on which are fixed a Bill, Talons, and Wings. To this is likewise fastened a Piece of that Flesh on which the Bird feeds; and the *Lure* is thrown out to him, when they intend to reclaim or recal him. The Sight of the Food he loves, with the Addition of a certain Noise, immediately brings him back. In a little Time, the Voice alone is sufficient. The various Plumage, with which the *Lure* is set off, is called a *Drawer*. When they accustom the Hawk to fly at a Kite, a Heron, or a Partridge, they change the *Drawer* according to the Game in View. When he is to spring

spring at a Kite, they only fix the Bill and Feathers of that Bird on the *Lure*: The same Care is taken with respect to the rest. And in order to entice the Bird to his Object, they fasten to the *Lure* the Flesh of a Chicken, or some other Fowl, but always conceal it under the *Drawer*, or the Feathers of the Game they propose to fly at; to this they add Sugar, Cinnamon, Marrow, and other Flavours, proper to determine the Hawk to one particular Flight rather than another; by which Means, when he is afterwards to spring at any real Game, he falls upon his Prey with a surprising Precipitation. After three Weeks or a Month's Exercise in a Chamber or Garden, they begin to make an Experiment of the Bird in the open Fields, and fasten little Bells to his Feet, in order to be more readily informed of his Motions. He is always capp'd; that is to say, his Head is covered with Leather, which falls down over his Eyes, to prevent him from seeing any Object but that they would have him discover; and as soon as the Dogs either stop or spring the Game they are in Quest of, the Falconer uncaps the Bird, and tosses him into the Air after his Prey. 'Tis then very diverting to see him wing the Air in all the Varieties of Flight; and behold him soaring by Degrees and repeated Springs, till the Eye loses him in the middle Region. He then commands the Plain; contemplates the Motions of his Prey, whom the Distance of its Enemy deludes into an imaginary Security, till at last he launches upon it with the Rapidity of an Arrow, and bears it to his Master, who recalls him. They never fail, in these his first Essays, to present him, when he returns to his Fist, with the Neck and Entrails of the Prey he has brought. These Gratuities, and the other Caresses of the Falconer, animate the Bird to perform his Duty; keep him in Regularity, and a proper Fierceness of Temper, and particularly prevent him from *bearing away his Bells*; that is to say, from flying off, so as to return no more, which is an Accident that sometimes happens.

But I am very much in the wrong, to entertain the *Chevalier* with a Diversion which, without doubt, he has frequently seen.

Chevalier. I have beheld this Sport with Pleasure, but was never acquainted with the Manner of training up the Bird;

Bird; and should be glad to know how the Gentleman, who is your Neighbour, teaches his Falcons to fly at Hares and Rabbits, as well as any other Game.

Count. This is what they call *flying a Bird at the Furr*; and there are some Falcons who are taught to *fly at the Furr and the Plume*; or in other Words, they are trained up to fly at a Hare, as well as at a Pheasant, or any other Game, and the Difficulty is not great. When the Falcon is very tame, they take a living Hare, and break one of his Legs, or else they use a Hare's Skin stuffed with Straw; and after they have fixed to it a Piece of Chicken's Flesh, or whatever Food the Falcon loves best, they tie this Skin with a little Cord of a great Length, the End of which is fastened to the Girth of a Horse; and as the Skin is dragged along by that Creature, the Bird imagines it to be a Hare in Flight, which allures him to dart upon it; and by this Means he is taught to distinguish that Animal.

The Gentleman you mentioned has still a better Method, He has taught Birds to fly at a Roebuck, a wild Boar, and even a Wolf; which is sometimes very serviceable when the Wolves multiply their Breed. The Manner in which he proceeds is this:

He * accustoms his young Falcons betimes to eat what is prepared for them out of the Sockets of the Eyes of a Wolf, a Boar, or some other wild Beast; for which Purpose, he preserves the Head and Skin of the first Animal he can kill, and stuffs it in such a Manner that the Creature seems to be alive, and the Falcons have nothing to eat but what they pick out of the Cavity of the Eyes; when this is done, he begins to move this Figure gradually whilst the Falcon is feeding. The Bird learns to fasten itself to it, tho' the Beast is drawn backwards and forwards with a very precipitate Motion. He would lose his Meal, were he to quit his Hold; which makes him industrious and attentive to fix himself well on the Skull, that he may dig his Bill into the Eye, notwithstanding the Motion. When these first Exercises are over, our Gentleman places the Carcass on a Cart, drawn by a Horse in full Speed.

* Gamelli Carreri. Tom. II. p. 253.

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* Gamelli Carreri. Tom. II. p. 253.

The Bird follows it, and is perpetually feeding; and when they come to fly him in the Field, he never fails to dart on the first Beast he discovers, and immediately fastens on his Head, in order to scoop out his Eyes; this throws the Creature into Agonies, he stops and gives the Hunter Time to approach and kill him without any Danger, because the Beast is more engaged with the Bird than the Sportsman.

Chevalier. 'Tis not in the Power of Dogs to perform the Services we receive from such Birds.

Prior. Greater Feats than this are sometimes accomplished; and * Eagles themselves are beneficial to some People, without being tamed. I knew a Gentleman who kept an excellent Table, and had only an Eagle for his Steward, who supplied him with all the Dainties that were served up.

Chevalier. Had the Steward a good Salary?

Prior. You shall hear his Services, and his Gratitude. In a Journey I have already given you some Account of, I was in Company with a very curious Nobleman, who had an Inclination to see the Antiquities of *Nismes*, before he came to *Marseilles*. We took our Rout through *St. Flour*, in order to proceed from thence to *Mende* in the *Gevaudan*, and cross the *Cevennes*. As he was charged with a Commission from Court, he was every where received with particular Marks of Distinction. An Officer of Note, in the Neighbourhood of *Mende*, invited him to pass a few Days at his Seat, and entertained him in the politest Manner he was able. At the first Collation he gave us, we observed with some Surprise, that all the wild Fowl brought to the Table wanted either a Head, a Wing, a Leg, or some other Part, which occasioned our Gentleman to say very agreeably, that we must pardon the Voraciousness of his Caterer, who always tasted what he had prepared before it came to the Table. When we asked him whom this Caterer might be, and he perceived we grew facetious at this new Mode of Entertainment, he expressed himself in this Manner: In these mountainous

* *Memoirs de la vie de M. Aug. de Thou*, l. iv. p. 157. *Rail Synopsis. Method. Avium.* p. 6.

Parts, which are the richest in the Kingdom by reason of their Fertility, the Eagles are accustomed to build their Airies in the Cavities of some inaccessible Rock, which is hardly to be ascended by the Aid of Ladders and grappling Irons. As soon as the Shepherds have made this Discovery, they raise a little Hut at the Foot of the Rock, where they screen themselves from the Fury of these dangerous Birds, when they convey Provision to their Young. The Male carefully nourishes them for the Space of three Months, and the Female is engaged in the same Employment, till the Bird is capable of quitting the Airy; but when that Period is compleated, they make him spring into the Air, and bear him up with their Wings and Talons, when he is in Danger of falling. Whilst the young Eagle continues in the Airy, the Parents ravage all the neighbouring Country; Capons, Chickens, Ducks, Lambs, Kids, and Pigs suffer on this Occasion; they seize whatever falls in their Way, and bear it to their Young. But the Fields and Woods supply them with their best Game; for there they destroy Pheasants, Partridges, Woodcocks, Wild-Ducks, Hares and young Fawns. The Shepherds, at the very Instant they perceive the old Birds have left their Airy, plant their Ladders and climb the Rocks as well as they are able, and then they carry off what the Eagles have conveyed to their Off-spring; and in the Room of what they take, leave the Entrails of certain Animals. But as this cannot be done so expeditiously, as to prevent the young Eagle from devouring Part of their Food, the Shepherds must necessarily bring away what has been already mutilated; but in recompense for this Disadvantage, what they thus take has a much finer Flavour than any Thing the Markets afford. The Gentleman added, that when the young Eagle has Strength enough to fly, which requires a considerable Time to attain, because he is deprived of an excellent Food, and obliged to take up with what is very indifferent, the Shepherds fasten him to the Airy, that the Parent Birds may continue to supply him with what they take, till the disagreeable Task of providing for an Offspring that perpetually fatigues them, obliges first the Male, and then the Female to forsake him. The Male transfers himself to a new Situation, and the

Female follows the Track of her faithful Mate; after which their Tenderness for another Progeny makes them forget the former, whom the Shepherds leave in the Airy, to starve, unless they are compassionate enough to remove him.

This is a Fact we were assured of by the Gentleman, who acquainted us, that three or four of these Airies were sufficient to furnish a splendid Table throughout the Year; and instead of murmuring at the Creator of Eagles and Vultures, he thought himself very happy in their Neighbourhood, and reckoned every Airy of an Eagle or Vulture on his Estate, equivalent to an annual Rent.

Count. Since the Conversation turns on Eagles, I must acquaint the *Prior* that we have a young one in Company, who already begins to fly alone; I mean the *Chevalier*, who came this Morning into my Cabinet, to read and make Examinations, confront Authors, and write Observations. We have nothing now to do but leave him to himself.

Chevalier. Call me rather a *Nias* Bird, who has never seen any Thing. — I was anxious to know what became of Swallows, and such a Multitude of other Birds we see for a Season, and which suddenly disappear: And I shall now declare what I have collected on that Article.

Some Birds of Passage delight in cold Countries, others are pleased with temperate Climates, or even the hottest Regions. Some Species content themselves with passing from one Country to another, where the Air or Aliment attracts them at a certain Season. Others traverse the Seas, and undertake surprising Voyages. The Birds of Passage most known are Quails, Swallows, wild Ducks, Plovers, Woodcocks, and Cranes; but there are several other Species.

In the Spring, Quails pass from *Africa* into *Europe*, to find a more tolerable and moderate Summer than they could enjoy in the Country from whence they came. * Towards the Close of Autumn, they return over the *Mediterranean*, to obtain, in *Barbary* and *Egypt*, a gentle Heat, corresponding to the Climates they abandoned, when the Sun was on the other Side of the Equator. The Quails take

* Bellon.]

their Flight in Troops that sometimes resemble Clouds : They frequently cover Ships, and the Sailors take them without any Difficulty.

Swallows seem to have a different Procedure. Multitudes of them, as it is pretended, cross the Sea. But the Accounts from *England* and *Sweden* make it evident, that several, or at least those of the most Northern Countries, continue in *Europe*, and conceal themselves in the Caverns of the Earth rivetted to one another with their Claws and Bills. * They flock to Places unfrequented by Man, or even bury themselves in the Water. The Precaution they take to lubricate their Feathers with their own Oil, and to roll themselves up like a Ball, their Head within, and their Back without, preserves them in the Water, and even under the Ice. They are there benumb'd, and pass the whole Winter without Motion. The Heart however has a constant Palpitation, and the Warmth unchills them at the Return of Spring. They then revisit their former Habitations, and each Individual finds out his own Country, and his particular Village, City, and Nest.

As to Wild-Ducks and Cranes, both the one and the other, at the Approach of Winter, fly in quest of more favourable Climates. They all assemble at a certain Day, like Swallows and Quails. They decamp at the same Time, and 'tis very agreeable to observe their Flight. They generally range themselves in a long Column like an I, or in two Lines united in a Point, like a V reversed. The Duck, or Crane, who forms the Point, cuts the Air, and facilitates a Passage to those who follow ; but he is charged with this Commission only for a certain Time, at the Conclusion of which he wheels into the Rear, and another takes his Post. They have the Reputation of many other Dexterities ; but his Lordship has advised me not to be too credulous in that Particular, and has consequently abridged my Quotations.

Countess. I have frequently heard People talk of a Species of little Men a Foot and a half high, who, as they

* See the Account given to the Royal Society at London 12 Feb. 1713. Philosophical Transactions and Journal of the Learned, 1666. and 1667.

say, make War with the Cranes at their Arrival on the Coasts of the Red Sea: I think they call them Pygmies.

Prior. These little Men are the Apes, who battle the Cranes in Defence of their Young, which these Birds endeavour to destroy.

Countess. Though it has been familiar to me, every Autumn, to take notice of a certain Day when the Swallows meet, in order to depart all together, and notwithstanding I have frequently seen Flights of Birds on their Journey, I always thought the Fact very miraculous. In their Progress over Seas and Kingdoms, I was at a Loss whether I should most admire the Force that sustains them in so long a Passage, or the Order in which the Whole is accomplished. Who acquainted their Young, that it would soon be necessary for them to forsake the Land of their Nativity, and travel into a strange Country? Why do those who are detained in a Cage, express so much Disquietude at the Season for the usual Departure, and seem to be afflicted at their Inability to join the Company? What particular Bird charges himself with the Care of assembling a Council, to fix the Day of their Removal? Who sounds the Trumpet to inform the Tribe of the Resolution taken, that each Party may be prepared? Whence have they their Almanack to instruct them in the Season and Day, when they are to be in Motion? Are they provided with Magistrates to preserve the Discipline which is so extraordinary among them? For not one of them dislodges till the Proclamation has been publish'd, and not a Deserter is to be seen on the Day that succeeds their Departure. * Have they Charts to regulate their Voyage by? Are they acquainted with the Islands where they may rest, and be accommodated with Refreshments? Are they furnished with a Compass to guide them infallibly to the Coast they would steer to, without being disconcerted in their Flight by Rains, or Winds, or the dismal Obscurity of many Nights? Or are they endued with a Reason superior to that of Man, who has not Courage to attempt such a Passage, without a Multitude of Machines, Precautions, and Provisions?

Prior. 'Tis very certain, Madam, they have neither Charts, nor Compass, nor Reason; the Deity alone is their

* Explic. de l'ouv. des 6 jours.

Conductor, and impresses on each Individual, a particular Method and Train of Sentiments that suffice for their Condition.

Count. If these Operations were the Result of a Reason that was proper and personal to them ; if God had abandoned them to their particular Understanding, that very Faculty, which appears in them so admirable and extensive, would not always be subject to the same Formality of Action.

Prior. Without doubt, for all the Individuals of the same Species, if they had the same Rule and Principle of Conduct we possess, would vary in their Apprehensions like ourselves. The Swallows in *China* would not build like those in *France* : The *Asiatic*, the *Greek*, and the *Roman* Taste would prevail among them ; and as the two latter would be cultivated by the Swallows of *Italy* and *England*, these would look with Compassion on the *Chinese* Architecture ; and even in *France*, the Swallows of *Paris* would not build and live like their Provincial Brethren ; without doubt, they would follow the Mode, and communicate it to the rest ; they would afterwards despise that very Mode as a ridiculous and *Gothic* Taste, when they had once taken it into their Heads to establish another. Were Swallows possessed of Reason, it would introduce Subordination. The most rational or enterprising among them would doubtless acquire the first Station in the Community ; and, by a necessary Consequence, the Swallows of Distinction would not mix with the Vulgar, but leave the Labour to them. They would make a serious Affair of Chirping with greater Delicacy than the rest ; they would refine on the Manner of polishing their Feathers, and adjusting their Behaviour ; they would assume what is called a fine Air, and those who made the latest Appearance would be more graceful than their Elders. In a Word, if Swallows had the Faculty of Reason, they would perpetually invent, reform, and perfect, and, like ourselves, do a thousand rational and important Things, of which, at present, they have not the least Idea.

Countess. You have a great deal of Reason to rally our Extravagancies. The Beasts have that Simplicity and Decorum of Conduct, as would incline one to believe they were endued with Reason ; and our Actions are frequently

so capricious and indiscreet, that one would imagine we did not reason at all.

Prior. 'Tis evident however, that the Operations of Beasts are attended with so much Certainty, only because an Almighty Providence has regulated the Circumstantials; whereas the Inequality that appears in the Conduct of Men, demonstrates their Enjoyment of a Reason which varies in its Limitations, and a Liberty as diversified in its Choice. But we wander from the Subject; let us return to the Inhabitants of the Air.

Chevalier. Are there any left who deserve a particular Attention?

Prior. I can think of none but the different Night Birds. Species of Night Birds. * All the other Tribes sing before the Sun rises, and perform the same Homage to him after he is set: But amidst this general Applause that is paid to the Light, the Birds of Darkness are alone implacable against it: They avoid it as their Enemy, never permit it to be the Spectator of their Actions, and whilst it illuminates the Universe, they conceal themselves in Dens of the deepest Gloom. They wait with Impatience for the Return of Darkness, that they may steal out of their Prisons, to which the Day-light had banished them; and they then testify their Joy by Screams, that are only capable of infusing Horror and Consternation into the Minds of all who hear them; for each of these Birds has its particular Cry, according to the Species, but they are all very doleful and alarming. Their Figure discovers something hideous and gloomy; and one would imagine he saw a settled Aversion against Man and all Animals, low'ring in their Features. Almost all of them have a hooked Bill, and sharp Talons, out of which the Prey, when once seized, has no Possibility of Escape; and they employ the Hours of Darkness and Slumber in surprising other Birds who are taking their Repose, the most vigorous of whom with Difficulty elude them, but the weakest are their infallible Prey. They likewise add Craft to Cruelty, and Artifice to Rage; and after they have kept Watch for the public Calamity, they retire, before the Rising of the Sun, into Caves inaccessible to the Light. They general-

* Explic. de l'ouvr. des 6 jours.

ly prefer old Castles, and mouldering Piles, to any other Retreat, as if melancholy Ruins and Desolation, which intimate the Neglect of the Master, or the Declension of Families, were capable of inspiring Sentiments of Alacrity in these fatal Birds.

'Tis impossible, in collecting all these Particulars, not to trace out the Image of those Dæmons of Malice and Darkness, who are put to Flight by the Lustre of Youth; who delight in every Thing that clouds it; take Advantage of the Hours of Negligence and Sleep, to devour the Souls they detain in Fetters of Iron, when they have once seized them; who nourish themselves with their Calamities and Losses, and reside, with the greatest Satisfaction, in perverted and ruined Hearts. The holy Scripture authorizes this Parallel between Dæmons and Birds of the Night, and confirms us in the Belief, that God, whose Wisdom is infinite, has replenished the Prospect and Order of Nature with profitable Instructions for Salvation. *Babylon*, * says the Scripture, is become the Habitation of Devils, and the Hold of every foul Spirit, and a Cage of every unclean and hateful Bird.

As the Birds of Darkness are Enemies to every other Class, they, in their Turn, are equally detested; and when the Owl, the Horn-Coot, the Osprey, and the like, are discovered, and detected by their Cries, or any other Accident, there is a general Association against the dismal Bird. The small and great surround him with a loud Noise, though it is but seldom he is attacked with much Impunity. The Fowlers find their Account in this public and declared Aversion, when they spread their Nets for those who imprudently rush out, at the real or imitated Cry of one of these Birds, who is such an Enemy to the rest. For they build a Hut near a Wood, and cover it with the Branches of Trees, and then, in several Parts of the Hut, fix Lime-twigs, on which the Birds of all Kinds descend and perch, the better to insult their Adversary, whose Cry revives their Animosity against him; and when they fall with the Lime-twigs that are not strongly fixed, they soil and embarrass their Wings in the Glew, and lose both Liberty and Life

* Revelations xvii. 2.

in the Hands of the Fowlers, who are attentive to observe their Fall, and take Advantage of their Rashness.

Countess. This little Sport is very entertaining. You are no Stranger to it, *Chevalier*, I suppose.

Chevalier. I know it is called the Decoy, and have frequently heard it mentioned; but it is a Pleasure that has been only promised me as yet.

Countess. We must give you the Enjoyment of it then.

Count. No later than to-morrow; but can you rise before the Sun?

Chevalier. I will take upon me to wake the whole House.

Count. Let us go then, and order the necessary Preparations.

Chevalier. It shall be my Business to collect all the Cages in this House, as well as the *Prior's*, and those of the whole Village.

Count. We will furnish you with every Thing, without obliging you to go any where else; and, believe me, you shall always have more Cages than Birds.

The End of the Eleventh DIALOGUE.

TERRE.

TERRESTRIAL ANIMALS.

D I A L O G U E X H.

The COUNT, *and* COUNTESS.
The PRIOR, *and* CHEVALIER.

Countess. **P**RAY, tell me, Sir, whilst we
 are waiting for our Company, Terrestrial
 which Sort of Life is most agreeable to Animals.
 you, that of an Academic, or that of a
 Fowler?

Chevalier. That of an Academic is more instructive.

Countess. That's the Answer of a true *Norman*. Speak
 to me without Reserve, if one should propose to you a
 Lecture in Philosophy, or a second Decoy in the Woods,
 how would you determine?

Chevalier. I would immediately prepare the Lime-
 twigs.

Countess. This is natural and undisguised: But however,
 instead of the Decoy, which cannot be frequently repeated,
 because the Birds are shy of approaching the Place where
 the Net has been spread, and then you must build a new
 Hut; I say, instead of this, I promise to entertain you
 with the Diversion of Fishing, as often as you please,
 which will be equally amusing. In the mean Time, let
 us single out the large Beasts, and turn the Conversation
 to Terrestrial Animals. But here are our Company.

Gentlemen, if you are not dissatisfied at my regulating the Subjects of our former Conversations, permit me to continue in that Province. If I should let you chuse, you would perhaps convey me into a Country of which I have no Map. After our Speculations on Insects and Birds, it would not be improper to proceed to Terrestrial Animals, such as the Sheep, the Ox, the Lion, and the Elephant himself, if you please; for my own Part, I shall confine myself to what is most common.

Count. Those Creatures, Madam, who are most common, deserve our strictest Attention. We need not go to *Asia*, to discover Subjects for Admiration, since we are surrounded with them at Home.

Countess. I desire, Gentlemen, you would chuse *Asia* and *Africa* for yourselves, and, if you please, you may take in *America*; here certainly is enough to give you Satisfaction. If you take the common Animals, you deprive me of all my Quota, and your President will have nothing to say.

Prior. The Subject is copious, and will never be exhausted by our dividing it. Domestic Animals alone would furnish out twenty Conversations. *Chevalier*, be pleased to open the Conference. Without any Study or Preparation, you will be sensible of one of the finest Instances of the Deity's Bounty to Man, only by your answering a single Question. If one should search the Woods for a Set of young Wolves, a Number of Fawns, and as many young Lions, would it not be possible to bring them up, to tame and distribute them in three Classes, according to their Species, and nourish them in the Fields, like Sheep and Calves?

Chevalier. It would be altogether impracticable. I am sensible we might rear them, and soften a little of their Fierceness; but these Animals have always a savage and traiterous Disposition. One could never keep them long, and much less lead them by Drovers.—We had two young Wolves brought up at our House, who seemed to be very sociable, but they soon took Care to undeceive us. The fly Animals were pleased one Morning to quarrel with a Dog, and thought fit to tear him to Pieces; they likewise did us the Favour to kill three Kids, and then marched off to the Woods.

Prior.

Prior. You have imagined till now, that this Union of a large Herd of Cows, or a Flock of Sheep or Goats under the Conduct of a single Shepherd, or the Wand of a Youth, was the Consequence of Man's Industry. But what Opinion do you entertain, when you consider this Matter with a little Attention?

Chevalier. I am very sensible that this Union is the Work of God alone, and one of the most amiable Presents he has condescended to make us.

Prior. Were it possible to tame Lions and Bears, yet we could never make them labour, or carry Burdens; but granting even this to be practicable, would they submit to feed on the Herbage of the Field? Education never changes Nature; and were they to be nourished according to their libertine and ravenous Inclinations, they would soon ruin their Master, instead of assisting him in his Labours; on the contrary, the generality of domestic Animals are but little expensive, they work hard, and the Habitations of Men are more agreeable to them than their own Liberty. They are furnished with great Strength, they employ it only in their Owner's Service; and immediately obey his first Command. What Gratuity do they expect for their Toil? Why true a little Glafs, and even the very driest, or least valuable of all our Grain, suffices them: The most delicious Food has no Attractions for them, and they reject it with as much Aversion as if it were Poison. Has any Part of our Care produced in them Inclinations so abstemious and beneficial to us? Are they formed by our Industry? No certainly, and the *Chevalier* has very justly called them, one of the Deity's most amiable Presents.

Countess. One must be either blind or ungrateful to deny this Truth; for these Creatures are not only tractable, but naturally loving; they come to tender us the Variety of their voluntary Services, and never keep themselves at a Distance from us. Whereas the others, who are not pre-ordained to share our Labours, content themselves with doing us no Injury, unless they are, in a manner, compelled to it, and retire to Woods and Deserts, out of respect to Man, to whom they resign all the rest of the Earth.

Chevalier. Providence discovers itself in the benevolent Inclinations implanted in domestic Animals. But I would

willingly know how we can reconcile the voracious Dispositions of wild Beasts, with the Goodness of God: Does a Wolf, who darts on a Flock of Cattle, seem a proper Object to do Honour to his Providence?

Prior. He undoubtedly honours it in his Sphere, since he accomplishes the Views proposed in his Creation. Providence has formed some Animals to live with Man, and be serviceable to him; and has created others, to people Woods and Deserts, animate every Part of Nature, and chastise Morals when they grow impious and abandoned. The same Providence appears admirable, in the Complacency it infuses into Animals, who live for the Benefit and Support of Mankind; and is its Intention less conspicuous, in the Preservation of all those savage Beasts, whom it nourishes in Rocks and Solitudes, without Folds or Pasture, without Magazines, or any other Assistance of Man's Contribution; or rather, in Opposition to all his Endeavours to destroy them? And who with all these Disadvantages are better accommodated with every Necessary, have more Activity for the Chace, are stronger, better nourished, and endued with more Vivacity, are cloathed with a finer Skin, and have a completer Turn of Shape, than the Generality of those who have Man for their Purveyor.

Countess. You see, *Chevalier*, that Providence shines and operates through all its Works, and rather merits our Adoration, than Criticisms in Matters above our Comprehension. But I desire we may return to our domestic Animals, and talk of things accommodated to my Capacity. Let his Lordship, for Instance, give us a Detail of his Horse's Perfections. The *Chevalier* may celebrate his Dog, whose Shape and Address he is so frequently boasting. I, as a good Oeconomist, declare for the Cattle, and the *Prior* is at Liberty to distinguish all the rest.

Count. I am very well satisfied with my
The Horse. Province. If Custom had not dignified the

Lion with the Title of King of Beasts, Reason, in my Judgment, would confer it on the Horse. The Lion is nothing less than the King of Animals; he is rather their Tyrant, since he is only capable of devouring, or inspiring them with Terror: On the contrary, the Horse is never injurious to other Creatures, either in their Persons or Properties: He discovers nothing that can expose

pose him to the least Aversion; he possesses no bad Quality, and enjoys all those that are amiable: Of all Animals, he has the finest Turn of Shape, is the most noble in his Inclinations, the most liberal of his Services, and the most frugal in his Food. Cast your Eyes on all the rest: Do you see on whose Head discloses so much Beauty and Gracefulness? Can we discover any Eyes that sparkle with more Fire? Where do we behold a more stately Chest, a lovelier Body, a Main that floats in the Wind with greater Majesty, and Limbs of a completer Flexibility? Let him be managed by his Rider, or divest him of his Bridle, and suffer him to expatiate in full Liberty through the Fields, you will observe, in all its Attitudes, a noble Deportment, and an Air which makes an Impression even on those who are least acquainted with his Virtues. He is still more engaging in his Inclinations, and indeed can properly be said to have but one, which is to render Service to his Master. Is he required to cultivate his Land, or carry his Baggage? he is always prepared, and would sooner sink under the Weight of his Labours, than decline them. Is he to bear his Master himself? he seems sensible of the Honour, he studies how to please him, and, at the least Signal, varies his Pace, is always ready to slacken, redouble, or precipitate it, when he is acquainted with his Rider's Will. Neither the Length of a Journey, nor the Unevenness of the Way, nor Ditches, nor Rivers the most rapid, can discourage him, he springs through every Obstacle, and as a Bird whose Career no Impediment can check. Is he called to any other Service; is it incumbent on him to defend his Master, or bear him to the Attack of an Enemy? he goeth out to meet the armed Men, he mocketh at Fear, and is not affrighted: The Sound of the Trumpet, and the Signal for Battle, awaken his Courage, and he retreats not at the Sight of the drawn Sword.

Countess. But this is a Panegyric, my Lord.

Count. I had a thousand Descriptions to make of the Boundings and other majestic Airs of a Horse; but since you rally me for the first Part of a Commendation that was unstudied, and couched in the most military Strain,

Job xxxix. 20.

you

you must excuse me from giving you the Second. Now, *Chevalier*, produce your Dog, and let us have a List of his Accomplishments.

Chevalier. I should be glad to see him here; for he is more agreeable than any The Dog. Description of mine can render him. He is called *Musti*, and is the King of *Shocks*. He has all that's pleasing in his Make; large Ears, graceful Whiskers, and a Ruff perpetually white. He has no Deficiency in his Exterior, and, with all this, has been well broke, and performs his Exercises with a peculiar Grace. He can hunt, dance, leap, and shew a hundred Dexterities. Among others, he brings to the Company, all the Cards any of them have named.

Countess. How is it possible to train up Animals destitute of Reason, to these Feats?

Chevalier. They have, at least, a certain Degree of Memory. A Dog is first taught, by repeated Trials, to know something by a certain Mark, and then to distinguish one Ace from another; they frequently offer him Food on a Card he is unacquainted with, after which they send him to find it out from the rest, and he never mistakes. The Habit of profiting by that Discovery and receiving Caresses, enables him, by Degrees, to grow acquainted with each particular Card, and he brings them with an Air of Gaiety, and without Confusion; and in Reality, 'tis no more surprising to see a Dog distinguish one Card from thirty others, than it is to see him distinguish, in the Street, his Master's Door from the rest in the Neighbourhood. But *Musti* pleases me most with his Disposition, and the little Policies natural to him. When I take my Books to go to the College, my poor Dog, who knows he is to be absent from me three Hours, puts on a melancholy and discontented Air. He plants himself before my Door, and waits for my Return. But if, instead of my Books, I take my Sword, and only mention the Word *abroad*, he flies to impart his Happiness to all the Neighbourhood; he runs up and down, and barks in such a Manner, as makes it impossible for any one to forbear laughing. If I make it long before I go out, he seems to suspect I am considering how to dispose of him; he marches off by way of Prevention, and waits for me at a considerable Distance from

from my Lodgings, full of Hopes to be one of the Party. If I tell him, that must not be, he expostulates with me, and endeavours to prevail on me to revoke my Orders: He puts on an Air that deservedly pleads Compassion, when he is positively told, that he must return Home; but there is no Instance of Gratitude which he does not testify, when I say to him, *Let us be gone.* But the Affair is quite otherwise, after I have been absent some Days; he imagines I return merely on his Account, commits a thousand Extravagancies, and a Couple of Hours are not sufficient for him to make me sensible of all he has at Heart.

His Friendship does not end there; he seems to watch Night and Day, to preserve me from being injured by any one. He is acquainted with all that passes, and gives me Intelligence of each Particular; but makes no Use of his Information, but what is conformable to my Orders; he reads his Behaviour in my Eyes, and when any one assaults me, a drawn Sword would not intimidate him. Some Months ago I began to practise Fencing, and the first Time I took my Lesson, he fastened on my Master's Leg; and ever since they are upon such indifferent Terms with each other, that I am obliged to separate them.

Count. In Reality, all the most ingenious Qualities a Dog is capable of acquiring, are not half so valuable as those lively and courageous Instances of Friendship he discovers for his Master; and it is evident, that God has consigned the Dog to Man, to serve him as a Companion, and to aid and defend him. The Services we receive from Dogs are as various as their Species.

The Mastiff and the Bull-dog guard our Houses in the Night, and reserve all their Malignity for the Season wherein People may form bad Designs against us. The Shepherds Dogs are equally qualified to assault the Wolves and discipline the Flock. Among the Class of Sporting Dogs, the Terrier has very short Legs, to enable him to creep under the Grass, and dart through Brakes and Bushes. The Greyhound to facilitate his Speed through the Air, has received a sharp Head and a slender Body: His Legs, that are so long and spare, stretch over a large Space of Ground, and in Swiftneſs he even exceeds the

the Hare, whose whole Safety consists in the Promptitude and Stratagems of her Flight. The Greyhound is the Contrast to the Terrier, as well in the Structure of his Body, as in his particular Functions: The latter has a weak Sight, and a fine Nose, because he is in greater need of a sure Scent than a piercing Eye, when he buries himself under Ground, or forces his Way through a thick Underwood: On the other hand, the Greyhound, who is only useful in the Plain has but an indifferent Nose, but then he never fails to see and distinguish his Prey at a Distance through all her Doublings. The Setting Dog stops and squats down when he sees the Game, to give his Master Notice of the Discovery. There are several Sorts of these Dogs, whose Names vary according to their Qualifications; but they are all equally zealous and faithful in accomplishing the Service prescribed them*. The Master, who is seldom satisfied with those Friends who accompany him, and are irregular at the Sport, is however charmed with the Capacity and Understanding of all his Dogs. At the Conclusion of the Chace, and the short Satisfaction of the Carnage, which is not always granted them, they all return to the Kennel and the String; they then forget their Fierceness, make a gay Surrender of their Liberty, and without murmuring submit to the coarsest Food. 'Tis sufficient for them to have regaled their Master with excellent Venison, and a polite Amusement.

In a Word, among all these various Domesticks, who are so submissive and devoted to our Interest, there are none, even down to *Spaniels* and the *Danish* Breed, but what render themselves agreeable by their Sprightliness, valuable by their Affiduity, and sometimes beneficial, by a seasonable Intimation given to their Master in his Slumbers. Among Animals, I know but very few, besides the Horse and Dog, with whom one can maintain a friendly Intercourse; and therefore the Proverb says, that a Man, a Horse, and a Dog, are never weary of each others Company.

Countess. Mankind have a commodious Vehicle in a Horse, a faithful Guard in a Dog, and in both, an agree-

* Explic. litt. de l'ouv. des 6 jours.

able and constant Amusement. But there are Things still more necessary for him to enjoy, such as Food and Raiment, and these he is supplied with by the Cattle. The Flesh of these Animals is so nourishing and perfect, that we leave the most exquisite Delicacies to return to them, and are never satisfied with the Collations they afford us. Whilst we permit them to live, how do they employ their Time? It is evident that the Cow, the Goat, and the Sheep, have been placed among us to increase our Riches: We feed them with a few Herbs, or allow them the Liberty to range in the Fields, and supply themselves with those Productions that are least beneficial to us, and they return every Evening, to repay this Obligation with a liberal Flow of Cream and Milk. The Night is no sooner passed, but they earn, by a second Payment, the Sustenance of the succeeding Day. The Cow alone furnishes the Poor with what suffices them next to Bread; and crowns our Tables with Riches and the most delicious Variety. The Sheep, content to be array'd only in Winter, resigns to us the Use of his Fleece in the Summer. In a Word, we derive from this Set of Animals, as well as those who are less regarded, an hundred other Conveniencies, which we cannot receive from those who fly from Man. The wild Beasts never approach us but with a View to rob us; the domestic Animals associate with us, for no other Reason, but to favour us with their Donations; and if the Value of their Presents is any way diminished, it is because we daily receive them, and think no more of them; they are depreciated by the Easiness of obtaining them. But, in Reality, this is a Circumstance which enhances their Merit. A Liberality that knows no Interruption, and is daily repeated, is ever worthy of new Returns of Gratitude; and the least we can do when we receive a Benefit, is to vouchsafe an Acknowledgment to the Donor.

These Animals are perpetually before our Eyes, and I daily discover some new Traces of a wise Ordination and a benevolent Providence. When I consider a Dam, I behold a Tenderness in her for her Young, that reaches even to Excess. The Young has no Knowledge of any Thing, and is in a perfect State of Incapacity: But the Fondness of the Mother supplies every Deficiency, and her

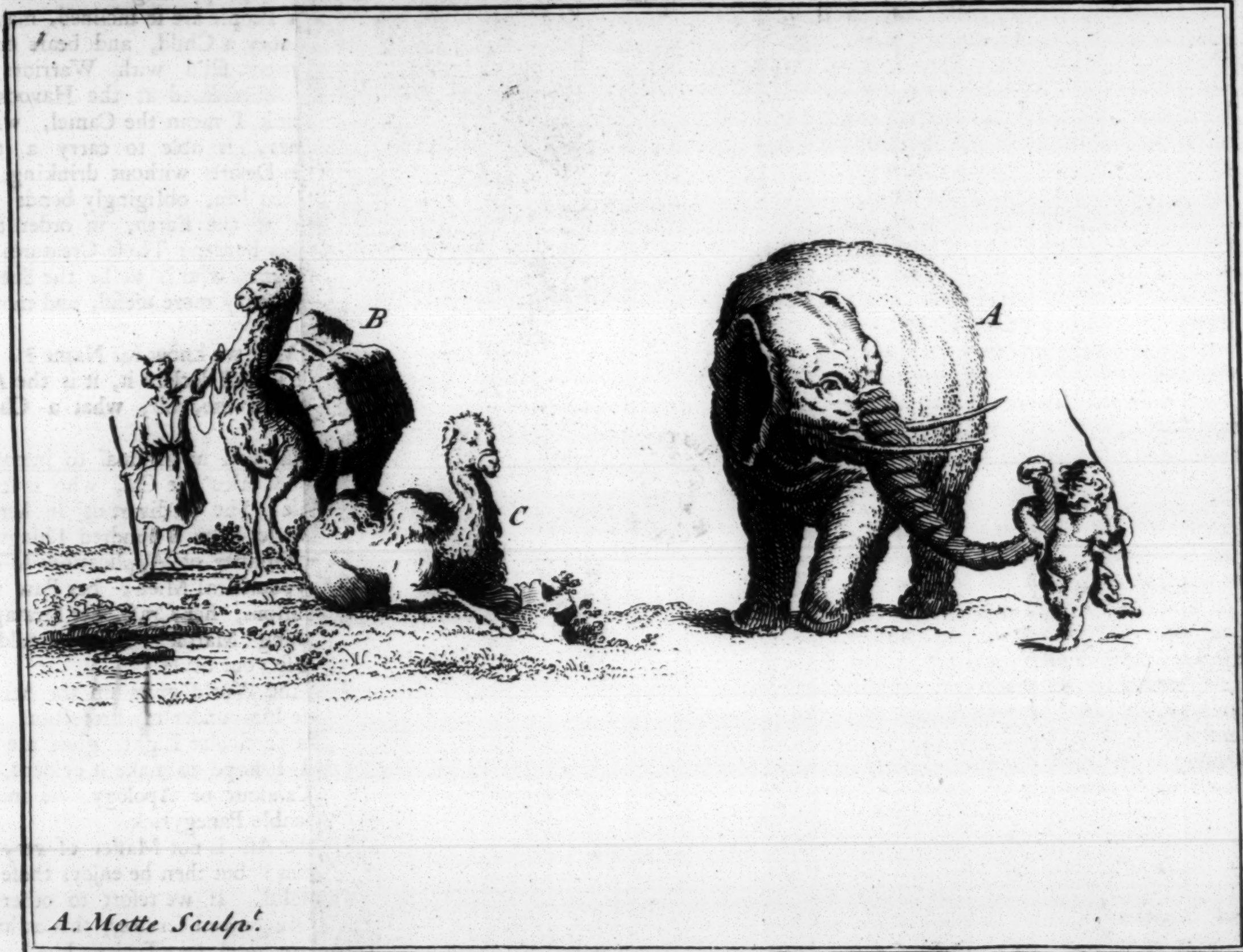
her Off-spring has all its Necessities relieved. If I cast my Eye on this Young, it is a new Object of Admiration, through all the Variety of its Progress; Before he is capable of seeing, it can find the Teat, and tho' it be ignorant of the Necessity of pressing it, the Creature very dextrously employs its two fore Paws alternately, and by these means presses out the Nourishment. If the Parent and her Offspring are separated for any Time, they seek one another with equal Impatience; and when they are near enough to be heard, they give mutual Notice by Cries, that are perfectly intelligible to them: The Mother can distinguish the Bleating of her Young, amidst a thousand Lambs; and this, amidst the Cries of a thousand Mothers, knows the Voice of the Parent who answers her. The Shepherd himself is deceived, but the Dam and her Young are never mistaken, and the mutual Informations they give of their Arrival, are soon succeeded by a grateful Re-union.

When the Young becomes strong, and capable of providing for himself, it is but reasonable that the Parent should be discharged from that Care; she accordingly drives him away, and treats him with Severity, if he persists in following her; and the Tenderness of the one continues no longer than the Necessities of the other; the Young, deprived of his Milk, is obliged to habituate himself to a less delicate Food; he learns to nibble the Grass, and ruminate in the Night, what he had cropped and reserved in the Day. By degrees he distinguishes the Seasons; In the long Days of Summer, he rests and ruminates, because he may do both without Hazard; but in the Winter, when the Days are short, he has no Time to lose; he eats with as much Dispatch as possible, and compleats the Digestion, by re-chewing the Food at his Leisure in the Night.

One might make a thousand Observations more on domestic Animals, but I am curious to know what the *Prior* has reserved for us.

Prior. The Animal, whose Panegyric I am going to make, has a Set of Qualities very peculiar. He is not used in all Places, but his Services are very extensive and profitable to Mankind; the whole World cannot produce a more laborious Creature, and at the same time, one
more

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.



A. Motte Sculp.

A. A tame Elephant. B. A Camel loaded. C. A Camel lying down to be unloaded.

more indefatigable, abstemious and patient. You imagine perhaps, I am speaking of the Elephant, who, if People are so inclined, may be taught to obey a Child, and bears on his Back Towers fill'd with Warriors, without being intimidated at the Havock of the Battle; or you may think I mean the Camel, who is serviceable in long Journies, is able to carry a thousand Pound Weight, crosses Desarts without drinking, and, as soon as he arrives at the Inn, obligingly bends his Knees, and lowers himself to the Earth, in order to facilitate the Discharge of his Burden: These Creatures have their Merit, but the Animal who is to be the Subject of my Discourse, is abundantly more useful, and more generally employ'd.

Chevalier. May we know his Name?

Prior. Since I must declare it, it is the Ass.

Chevalier. Bless me, Sir, what a Choice have you made?

Countess. Had you no Animal to introduce but this? Why did you not take the Cat, who is so very serviceable? She is diverting in her Play: You would have a hundred Things to say, and a Number of Applications to make, with respect to her hypocritical Mien; her Paw so soft, and yet armed with Talons, her Craft, her Stratagems, and perpetually designing March: There would be Matter enough to exercise your Style.

Prior. All the World gives up the Ass! and therefore I intend to take him under my Protection. This Animal, considered in a particular Light, gives me a great deal of Pleasure; and I hope to make it evident, that far from needing any Candour or Apology, he may be the Subject of a reasonable Panegyrick.

I confess, the Ass is not Master of very shining Qualities; but then he enjoys those that are very solid. If we resort to other Animals for distinguished Services, this at least furnishes us with such as are most necessary. His Voice is not altogether melodious, nor his Air majestic, nor his Manners very lively; but then, a fine Voice has very little Merit with People of Solidity. With him, the Want of a noble

ble Air has its Compensation in a mild and modest Countenance; and instead of the boisterous and irregular Qualities of the Horse, which are frequently more incommodious than agreeable, the Behaviour of the Ass is intirely simple and unaffected; no supercilious and self-sufficient Air. He marches with a very uniform Pace, and though he is not extraordinary swift, he pursues his Journey for a long Time, and without Intermision. He finishes his Work, in Silence, serves you with a steady Perseverance, and discovers no Ostentation in his Proceedings, which is certainly a considerable Accomplishment in a Domestic. His Meats require no Preparation, for he is perfectly well contented with the first Thistle that presents itself in his Way; he does not pretend any Thing is due to him, and never appears squeamish or dissatisfied; he thankfully accepts whatever is offered him; he has an elegant Relish for the best Things, and very civilly contents himself with the most indifferent. If he happens to be forgotten, or is fastened a little too far from his Fodder, he intreats his Master, in the most pathetic Language he can utter, to be so good as to supply his Necessities. 'Tis very just that he should live, and he employs all his Rhetoric with that View. When he has finished his Expostulations, he patiently waits the Arrival of a little Bran, or a few withered Leaves; and the Moment he has dispatched his hasty Meal, he returns to his Business, and marches on without a Murmur or Reply. These are certainly very valuable Accomplishments. Let us now see how he is employed.

His Occupations have a Tinge of the Meanness of those who set him to work, but the Judgments that are formed both of the Ass and his Master, are equally partial. The Employments of a Judge, a Man of Consequence, and an Officer of the Revenue, have an important Air, and their Habit imposes on the Spectators: On the contrary, the Labour of the Peasant has a mean and contemptible Appearance, because his Dress is poor, and his Condition despised. But we really make a false Estimation of these Particulars. 'Tis the Labour of the Peasant which is most valuable, and alone truly necessary. Of what Importance is it to us, when a Manager of the Revenue glitters from Head to Foot with Gold? We have no Advantage
by

by his Labours. I confess Judges and Advocates are, in some Measure necessary, but they are made so by our Follies and Misbehaviour; for they would no longer be wanted, could we conduct ourselves in a rational Manner: But, on the other hand, we could, on no Account, and in no Season or Condition of Life, be without the Peasant and the Artisan. These People may be considered as the Soul and Sinews of the Community, and the Support of our Life. 'Tis from them we are constantly deriving some Accommodation for our Wants. Our Houses, our Habits, our Furniture, and our Sustenance, rise out of their Labours. Now, what would become of your Vine-dressers, Gardeners, Masons, and the Generality of Country People, that is to say, two thirds of all Mankind, if they were destitute of either Men or Horses to convey the Commodities and Materials they employ and manufacture? The Ass is perpetually at their Service: He carries Fruits, Herbs, Coals, Wood, Bricks, Tiles, Plaster, Lime, and Straw. The most abject Offices are his ordinary Lot, and 'tis a singular Advantage to this Multitude of Workmen, as well as ourselves, to find a gentle, strong and indefatigable Animal; who, without either Expence or Pride, replenishes our Cities and Villages with all Sorts of Commodities. A short Comparison will compleat the Illustration of the Usefulness of his Services, and, in some measure, raise them out of their Obscurity.

The Horse very much resembles those Nations who are fond of Glitter and Hurry; who are perpetually singing and dancing, and extremely studious to set off their Exterior, and mix Gaiety in all their Actions. They are admirable, in some distinguished and decisive Occasions; but their Fire frequently degenerates into Romantic Enthusiasm: They fall into wild Transports; they exhaust themselves, and lose the most favourable Conjunctions, for want of Management and Moderation.

The Ass, on the contrary, resembles those People who are naturally heavy and pacific, whose Understanding and Capacity are limited to Husbandry, or Commerce, and who proceed in the same Track without Discomposure, and compleat, with a serious and positive Air, whatever they have once undertaken.

Countess. Would not one be tempted to think the *Prior's* Observations true in every Particular?

Count. There is certainly something more than Raillery in what we have heard; but at the same time it is insupportable, and contrary to all Decency, to make an Academic Oration in honour of such an Animal: 'Tis degrading us who are the Audience; and, if I am seconded, it will be declared by the Majority of Voices, that the *Prior* has not furnished his Contingent, and must therefore be obliged to make us amends for the Deficiency.

Chevalier. The *Prior* is in a fair way of making another Oration: I don't sentence him to begin again, but I confess I heartily desire it.

Countess. And for my Part, I join my Authority as President, to the Opinion of the Company, and declare, that the *Prior* ought to furnish us with a more popular Encomium; and if the Gentleman should not think it proper to chuse his Subject among the Domestic Animals let him have Recourse to those that are savage.

Prior. Those who make Laws, have a Privilege to interpret them: May I therefore be permitted to take some foreign Animal?

Countess. You may command the four Parts of the World: But pray favour me a Moment: Can you give us a Description of that Animal who is such an excellent Architect? I must beg you to assist my Memory, for I cannot recollect his Name.

Prior. I don't know any Animal who builds a more commodious Habitation, under Ground, than the Field-Mouse, who scoops out several subterranean Cells, that have a free Communication with one another; in some of these the Creature stores his Provisions, which consist of Fruits, according to the Season, but especially Nuts and Ears of Corn, which keep longer than any other Article of his Food, and are piled in Heaps. There are other Cavities, where the Family are disposed on little Beds of Wool and Flew. At the Extremity of the Lodge, is a Magazine that furnishes all the rest with Accommodations in a very elegant Manner.

Countess. It is good to know these Particulars; but this is not the Animal I meant.

Prior.

Prior. Perhaps your Ladyship means the Porcupine, or else the Hedghog, who have also their Magazines. There is a perfect Similitude between these two Species.

The Hedghog (of which we are acquainted with two Kinds, one more common, distinguished by the Snout of a Hog, the other less frequently seen, and form'd with the Nose of a Dog) is a small Animal, intirely covered with Prickles an Inch and an half in Length; and very like those which shoot from the Shells of Chestnuts. When he is attacked, he bends his Head and Paws under him, rounds himself into a Ball, and erects his pointed Quills, in such a Manner, that Dogs and other Animals are compelled to leave him.

The Porcupine is a much larger Creature, and his Length sometimes exceeds two Feet. He is shagged all over, with hard and sharp Hairs, of unequal Length; from two or three, to twelve Inches and more. These are shaped like the Stalks of Corn, with Intermixtures of black and white; they likewise swell towards the Middle, and terminate in a Point with two sharp Sides. This Animal presents his Side to his Enemy, erects all his Darts with a menacing Air, and sometimes plunges them so deep, in the Flesh of the Creature by whom he is assaulted, that several of them remain in the Wounds, and are detached from his Body when he retires. The Sockets of these are afterwards filled by others, which are enlarged by Time.

The Hedghog makes another Use of his commodious Darts, for he rolls himself over Apples, Grapes, and all other Fruits he can find under the Trees, and carries them off on his sharp Quills, in the best Manner he can. He eats what takes up most Room in his Cell, or is apt soonest to decay, and endeavours to have a Reserve of Nuts for the latter Season; but passes the Severity of the Winter in Sleep.

Countess. This Animal has likewise its Merit; but I am thinking of another, that my Merchant of *St. Malo* entertained us so agreeably with the other Day.

Prior. Her Ladyship means the Beaver.

Countess. The very same.

Prior.

Prior. But the Description of this Creature, Madam, will be infinitely more agreeable from you than me.

Countess. Very well indeed. What Sort of Conscience, Sir, do you act by? You first contract a Debt, and then desire another to discharge it.

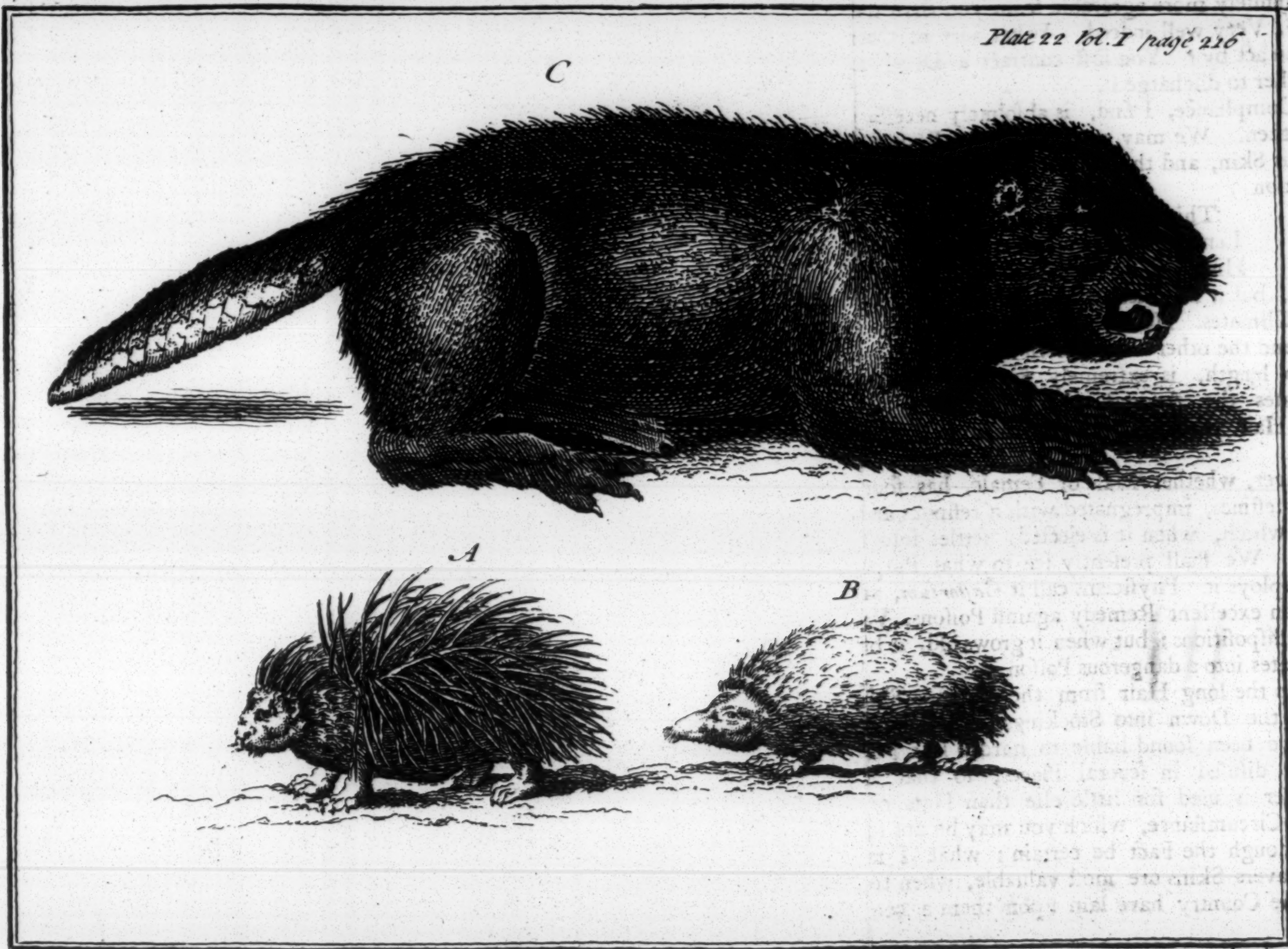
Prior. Compliance, I find, is absolutely necessary. To the Point then. We may consider, in the Beaver, the Use made of his Skin, and the Dexterity with which he builds his Habitation.

The Beaver. This * Creature is about four Foot in Length, and twelve or fifteen Inches broad. His Skin, in the Northern Regions, is generally black, but it brightens into a reddish Tincture in the temperate Climates. He is covered with two Sorts of Hair, one long, and the other a soft Down; the latter, which is an Inch in length, is extremely fine and compact, and accommodates the Animal with a necessary Warmth. The long Hair preserves the Down from Dirt and Humidity.

The Beaver, whether Male or Female, has four Bags, under his Intestines, impregnated with a resinous and liquid Substance, which, when it is ejected, settles into a thick Consistence. We shall presently see to what Purpose the Creature employs it. Physicians call it *Castoreum*, and prescribe it as an excellent Remedy against Poisons, Vapours, and other Indispositions; but when it grows old, it blackens and degenerates into a dangerous Poison.

They strip the long Hair from the Beaver's Skin, and manufacture the Down into Stockings, Caps and Stuffs; but these have been found liable to harden like Felt, and are therefore disused in several Places, so that at present the Beaver is used for little else than Hats or Furs. There is one Circumstance, which you may be apt to think incredible, though the Fact be certain; what I mean is this; the Beavers Skins are most valuable, when the wild Natives of the Country have lain upon them a considera-

* *Memoir de l'Academ. des Scienc. 1704. Lettre de Mr. Sarrazen Medecin. du Roi envoie au Canada. Voyage du Baron de la Honton. Memoires pour l'histoire des Animaux, de l'Imprimerie Royale.*



A. The Porcupine. B. The Hedgehog. C. The Beaver.

A. Motte sculp.

ble Time; for, by these Means, the long Hair falls off, and the Down becomes compact and moist by Transpiration, and consequently fitted to be manufactured. But I perceive the *Chevalier* will grow impatient, if I don't shew him the Beaver's Dwelling.

Chevalier. Will you begin, Sir, as you did with Bees, and inform me what Implements this Creature is furnished with for Building?

Prior. He has three, his Teeth, his Paws, and his Tail: His Teeth are strong, and deeply rivetted into his Jaws, with a long and crooked Root: With these he cuts, as well the Wood with which he builds, as that which furnishes him with his Food. His Fore-feet resemble those of such Animals as hold what they eat in their Paws, as Apes, for Instance, and Rats and Squirrels; with these Feet he digs, softens and works the Clay, which is extremely serviceable to him. His Hind-feet are accommodated with Membranes, or large Skins, extending between his Toes like those of Ducks, and all other Water-Fowl: This makes it evident, that the Author of Nature intended the Creature should be amphibious. His Tail is long, a little flat, intirely covered with Scales, supplied with Muscles, and perpetually lubricated with Oil or Fat: This Animal, who is an Architect from his Nativity, uses his Tail instead of a Hod, for the Conveyance of his Clay or Mortar, and a Trowel to spread and form it into an Incrustation: The Scales prevent these Materials from penetrating the Tail with their Coldness and Humidity. But the Scales, as well as the Tail, would be injured by the Air and Water, were it not for the Prevention of an Oil, which he distributes all over them with his Snout; and the Bags I have already mentioned, are undoubtedly the Magazines of this Fluid.

The Beavers inhabit the same Mansion in great Numbers, unless violent Heats or Inundations, the Pursuits of Hunters, Scarcity of Provisions, or the extraordinary Increase of their Offspring, oblige them to separate. In order to raise themselves a convenient Abode, they chuse a Situation that abounds with Sustenance, and is washed by a Rivulet, and where they may form a convenient Reservoir of Water for their Bagnio. They begin with Building a Mole or Causey, in which the Water may rise to a Level with the first Story of their Habitation.

L

Cheva

Chevalier. The first Story ! Have they a first and a second like ours ?

Prior. Exactly the same. But let us first examine the Causey, which forms their watering Place, and serves to raise the Water to a sufficient Height. This Causey, at the Foundation, may contain ten or a dozen Feet in Thickness : It descends in a Slope, on the Side next the Water, which, in Proportion to its Elevation, gravitates upon the Work, and presses it with a strong Tendency towards the Earth. The opposite Side is raised perpendicular like our Walls, and the Slope, which, at its Basis, is twelve Feet broad, diminishes towards the Top, whose Breadth does not exceed two Feet : The Materials of this Work are Wood and Clay. The Beavers, with an admirable Facility, cut the Pieces of Wood, some as thick as one's Arm, others as large as one's Thigh, and from two to four, five, or six Feet in Length, and sometimes more, in Proportion to the Ascent of the Slope. They drive the Extremity of these very near each other, into the Earth, and take Care to interlace them with other Stakes, more slender and supple. But as the Water, without some other Prevention, would glide through the Cavities, and leave the Reservoir dry, they have Recourse to a Clay, which they perfectly know how to procure, and with which they close up all the Interstices both within and without, and this intirely prevents all Evacuation. They continue to raise the Dike, proportionable to the Water's Elevation and Plenty. They are likewise very sensible, that their Materials are not so easily transported by Land as by Water, and therefore take the Opportunity of its Increase, to swim, with Mortar placed on their Tail, and Stakes of Wood between their Teeth, to every Place where they have Occasion for these Materials. If the Violence of the Water, or the Footsteps of Hunters who pass over their Work, damage it in any Degree, they immediately repair the Fracture, visit all the Edifice, and, with indefatigable Application, refit and adjust whatever happens to be disconcerted. But when they are too frequently persecuted by the Hunters, they only work in the Night, or else discontinue their Labours.

When

When the Causey or Dike is completed, they begin to form their Cells, which are round or oval Apartments, divided into three Partitions, raised one above another. The first is sunk below the Level of the Dike, and generally full of Water; the other two are formed above it. They raise this Structure, in a very solid Manner, on the Edge of their Causey, and always in Stories, that, in case the Water should ascend, they may dwell in an higher Situation. If they find any little Island near the Reservoir, they fix their Dwelling there, which is then more solid, and they are less incommoded with the Water, in which they are capable of continuing but a short Time: But if they are not favoured with this Advantage, they drive Stakes into the Earth with their Teeth, to fortify the Building against the Winds and Water. At the Bottom they strike out two Openings to the Stream, one conducts them to the Place where they bathe, and which they always keep very decent, the other is a Passage to that Quarter, where they carry out every Thing that would soil or rot the upper Apartments. There is a third Aperture much higher, calculated to prevent their being shut up, when the Ice has closed the Openings into the lower Lodgments. They sometimes build their House intirely on the dry Land, and sink Ditches five or six Feet deep, in order to descend to the Water. They employ the same Materials and Industry in the Structure of their Dwelling, as they use for the Causey. The Walls of the building are perpendicular, and two Feet thick. As their Teeth are more serviceable than Saws, they cut off all the Projections from the Wood that shoots out beyond the Perpendicular of the Wall; after which they work up a Mixture of Clay and dry Grass, into a kind of Mortar, with which, by the Aid of their Tails, they rough-cast the Out and Insides of the Work.

The Edifice is vaulted within, like the Handle of a Basket, and generally rises in an oval Figure. The Dimensions are proportioned to the Number of the intended Inhabitants. Twelve Feet in Length, and ten in Breadth, are sufficient for eight or ten Beavers. If the Number increases, they enlarge the Place accordingly. It has been asserted for a Truth, that there have been found above

four hundred of these Creatures, in different Lodgments communicating with one another. But these popular Societies are very rare, because they are too unmanageable and tumultuous, and the Beavers are generally better acquainted with their own Interests. They associate to the Number of ten or a dozen, and sometimes a few more: They are a Set of amicable and sagacious Inhabitants, in whose mutual Society they may propose to pass the Winter together, in a very agreeable Manner. They are gifted with a natural Arithmetic, which enables them to proportion the Place and Provisions to the Necessities of the Company; and as it is customary for every Individual to continue in the constant Possession of his own Cell, they never charge themselves with unnecessary Expences for any accidental Guests.

There are some Beavers called Terriers, who make their Abode in Caverns dug in a rising Ground, either on the Shore or at some Distance from the Water, to which they scoop out subterranean Trenches from their Cavern, which descend from ten to an hundred Feet in Depth. These Trenches furnish them with Retreats, situated at unequal Heights, and wherein they enjoy a Shelter from the Water when it ascends. Their Beds are made of Chips, which serve them instead of a Quilt, and of Grass, which accommodates them in the Nature of a Feather-Bed.

All these Works, especially in the cold Regions, are compleated in *August* or *September*, after which Period they furnish themselves with Provisions. During the Summer Season, they regale themselves with all the Fruits and Plants the Country produces. In the Winter, they eat the Wood of the *Ash*, the *Plane*, and other Trees, which they steep in Water, in Quantities proportionable to their necessary Consumption; and they are supplied with a double Stomach, to facilitate the Digestion of such a solid Food, at two Operations. They cut Twigs, from three to six Feet in Length; the large ones are conveyed, by several Beavers, to the Magazine, and the smaller by a single Animal; but they take different Ways. Each Individual has his Walk assigned him to prevent the Labourers from being interrupted by their mutual Occasions.

The

The Dimensions of their Pile of Timber are regulated in proportion to the number of the Inhabitants; and it has been observed, that the Provision of Wood for ten Beavers, comprehended thirty Feet in a square Surface, and ten in Thickness. These Parcels of Wood are not piled up in one continued Heap, but laid cross one another, with Interstices between them, that they may the better draw out what Quantity they want, and always take the Parcel at the Bottom, which lyes in the Water. They cut this Wood into small Particles, and convey it to their Cell, where the whole Family come to receive their particular Share. Sometimes they expatiate in the Woods, and regale their Young with a new Collation. The Hunters, who are sensible these Creatures love green Wood better than old, place a Parcel of the former about their Lodge, and then have several Devices to ensnare them. When the Winter grows severe, they sometimes break the Ice, and when the Beavers come to the Opening, for the Benefit of fresh Air, they kill them with Hatchets; or make a large Aperture in the Ice, and cover it with a very strong Net, and then overturn the Lodge; upon which the Beavers, who think to escape in their usual way, by flying to the Water, and emerging at the Hole in the Ice, fall into the Snare, and are taken.

Chevalier. 'Tis pity to overturn the Tenement of these poor Beasts; one can no where else discover such remarkable Industry.

Count. Travellers ascribe almost the same Inclinations and Labours to the Civet Cat, The Civet Cat. who is an Animal peculiar to *America*, and larger than our House Cats. This Creature, in every Particular, is a Beaver in Miniature, and therefore it would be needless to make him the Subject of any further Discourse.

Countess. *Chevalier*, do you take notice of what they are doing on the Bank of the Mote? 'Tis an Affair wherein you have some Concern.

Chevalier. Where are those Persons going with their Poles and Nets? 'Tis certainly a Party of Fishing, which her Ladyship has an Inclination to entertain me with:

I hope these Gentlemen will favour us with their Company.

Count. We are inseparable from the *Chevalier*, and esteem his Pleasures our own.

Prior. You know, my dear *Chevalier*, that I am a Fisher of Men: I hope your Employment will be agreeable to you, but you must permit me to have some Regard to mine.

The End of the twelfth DIALOGUE.

FISHES.

F I S H E S.

D I A L O G U E XIII.

The COUNT and COUNTESS.*The* PRIOR, and*The* CHEVALIER.

Countess. **C***Chevalier,* we are come to break in upon your agreeable Meditations. I observed you lying above an Hour on the Turf that borders this Bason: May one know what engaged so much of your Attention?

Chevalier. I have been making a Visit to the Perch and Carp I reserved out of our Yesterday's Fishing, and restored to Liberty in this Water: I threw some Bread to them, which they devoured with great Eagerness: I have observed all their Motions, which amused me with several Thoughts on the Nature of Fishes, and I have a number of Questions to propose to these Gentlemen. In the first Place, I am unable to comprehend, why the Water, that stifles all other Animals, should be no way injurious to these. I should likewise be glad to know what particular Food they subsist on; and how they are able, without Feet, Arms, Talons, Trunk or Sting, to advance and seize their Prey.

Countess. If your Meditations, *Chevalier*, always produce such reasonable Questions, indulge them frequently, and you will make great Discoveries. Every Particular you have mentioned has employed my Thoughts, and I should be glad to hear the Answers these Gentlemen are preparing.

Prior. I can give your Ladyship some Satisfaction, with respect to the Element and Food of Fishes, but it requires a more delicate Philosophy than mine, to account for their progressive Motions, and Manner of Swimming: This must therefore be his Lordship's Province.

I am going to resume the Contemplations of our amiable Philosopher. I stand on the Edge of the great Bason, and fancy myself the *Chevalier*, engaged in the following Train of Thought. I have constantly beheld all Nature replenished with Inhabitants. The Air is peopled with a hundred Classes of Animals; others expatiate in the Fields, and creep on the Surface of the Earth. There are Families in the deep Recesses of Woods, the Hearts of Leaves, and under the Bark of Trees. The very Bowels of the Earth are hollowed and inhabited: But all these Creatures, so different from each other in their Nature and Manner of Life, have one Circumstance in common among them, they breathe the fluid Air: But we are now considering another Element, in which they all die when they are plunged in it. Is it then impossible to live in the Water? And is that Element, which covers more than half the Globe, destitute of Inhabitants? Quite the contrary, I there discover a Variety of Tribes; and as the Animals who live on the Earth die in the Water, so I observe the Inhabitants of the Waves perish in the Air, and are incapable of living out of the Element to which they are consigned: But, notwithstanding all this, I find it difficult to comprehend in what manner their Blood, for with such they are furnished, is capable of Circulation, and why it is not coagulated and condensed by the extraordinary Chillness of the Waters. The terrestrial Animals are accommodated, either with Feathers, or a delicate Down, or cloathed with good Furs, garnished with Hair, to defend them from the Impressions of the Air, which is sometimes excessively cold; but I am not able to discover the least Similitude, in any of these Circumstances, among Fish. What are they supplied with to qualify them
for

for resisting an Element much colder than the Air? Let us recollect what we have sometimes observed, either in handling or opening a Fish: The first Thing that offers itself to the Touch is a certain Glew, that moistens all the Surface of the Animal's Body. In the next Place, I observe a Covering composed of strong Scales; and, before I come to the Flesh of the Creature, discover a kind of Lard or oily Substance, extending from one Extremity to the other, and encompassing the whole. I can neither comprehend, how these Scales receive their Formation, Growth, and Supplies, nor what is the Origin and Reservoir of this Oil: But these Scales by their Solidity, and this Oil by its Antipathy to the Water, supply the Fish both with Warmth and Life, and he could not be accommodated with a Robe more light and impenetrable; so that where-ever I direct my View, I perceive a Wisdom perpetually fertile in new Designs; perfectly acquainted with every Circumstance of its Work, and never contradicted or embarrassed by the Disobedience of the Materials it employs.

The Cloathing of Fish.

The Glew.

The Scales and Lard.

Chevalier. I begin to find I meditate very well. I am pleased to hear myself, and think it adviseable to continue.

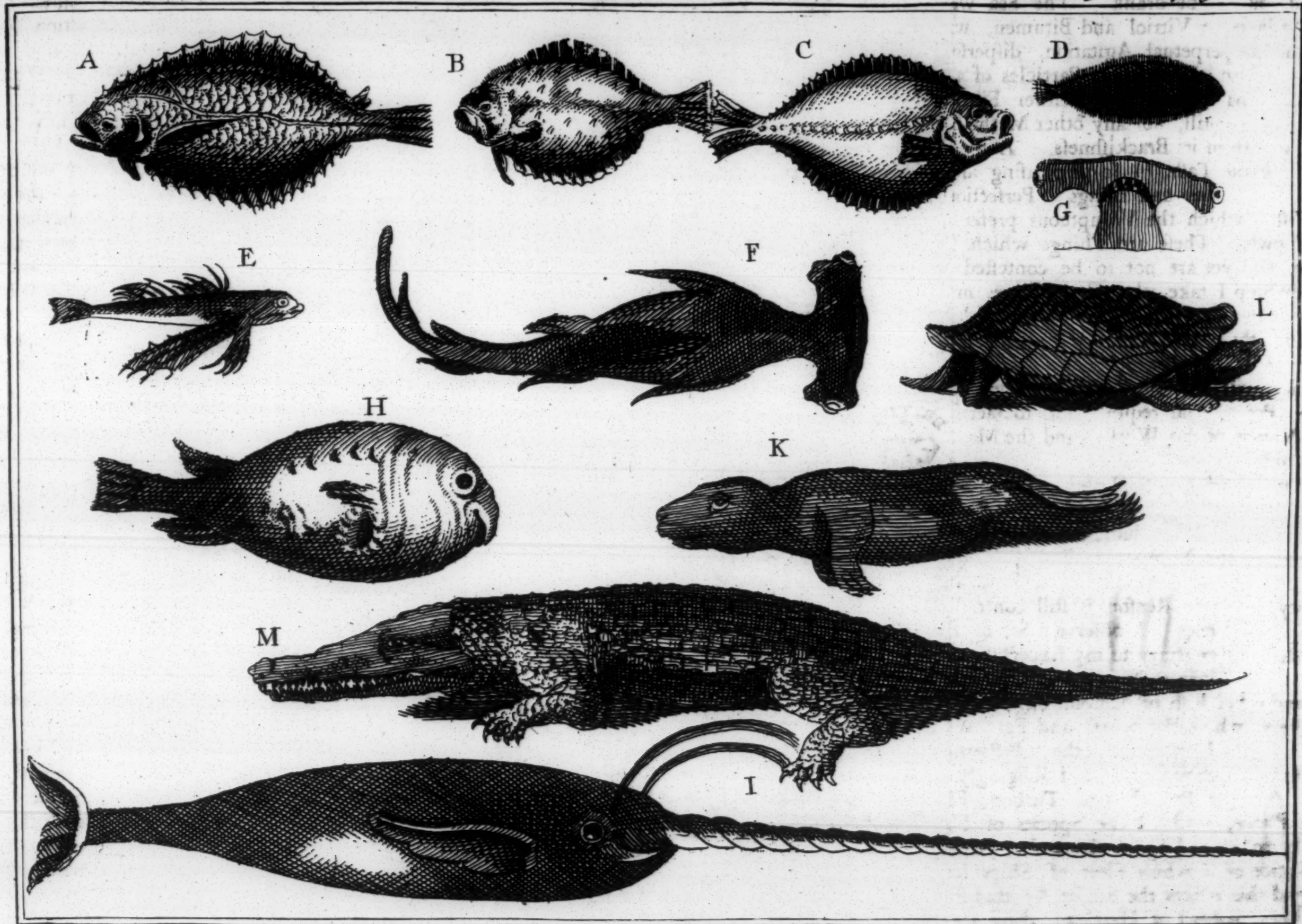
Prior. Let us do so. But, instead of the Basen's Edge, let us imagine we had the Shore of the Ocean in Prospect. Let us take our Station on an Eminence, from whence our View may be extended in full Liberty over this immense Basen, which was hollowed by the Hand of the Almighty. The Salt Waters which it contains, seem to have a manifest Sterility, or, if they give Life to some particular Animals, their Flesh will be improper for our Nourishment. But I find myself mistaken, and God has not constituted Man the Lord of the Fishes of the Sea, as well as of other Animals, in vain: I even observe a Multitude of Fisher-boats, sailing from all the neighbouring Shores, to collect the Bounties of the Sea, and which furnish us with a Nourishment equally diversified and delicate. Here my Astonishment redoubles. Navigators have made several Attempts to render the Water of the Ocean serviceable to them in long Voyages, and, according to some Accounts, have suc-

ceeded to a certain Degree, but this Water could never be made fit to be drank. The Sea washes from the Lands it laves, a Vitriol and Bitumen, which being like itself, in a perpetual Agitation, disperse and insinuate themselves into the smallest Particles of the Water, in so intimate a Manner, that neither Filtrations, nor the Power of the Still, nor any other Methods have been able to purify it from its Brackishness. And yet it is in this Water, whose Taste is so displeasing and insupportable, that God nourishes and brings to Perfection, the Flesh of those Fish, which the Voluptuous prefer to the most exquisite Fowls. These are Things which seem to be impossible, and yet are not to be contested. I am sensible, at every Step I take, that God obliges me to believe certain Doctrines in Nature, as well as Religion, of which he has not thought fit to impart to me an adequate Comprehension; and having judged it sufficient to disclose me, the Existence and Reality of the Wonders produced by his Power, he requires me to sacrifice my Reason to the Nature of his Works, and the Manner in which he effects them.

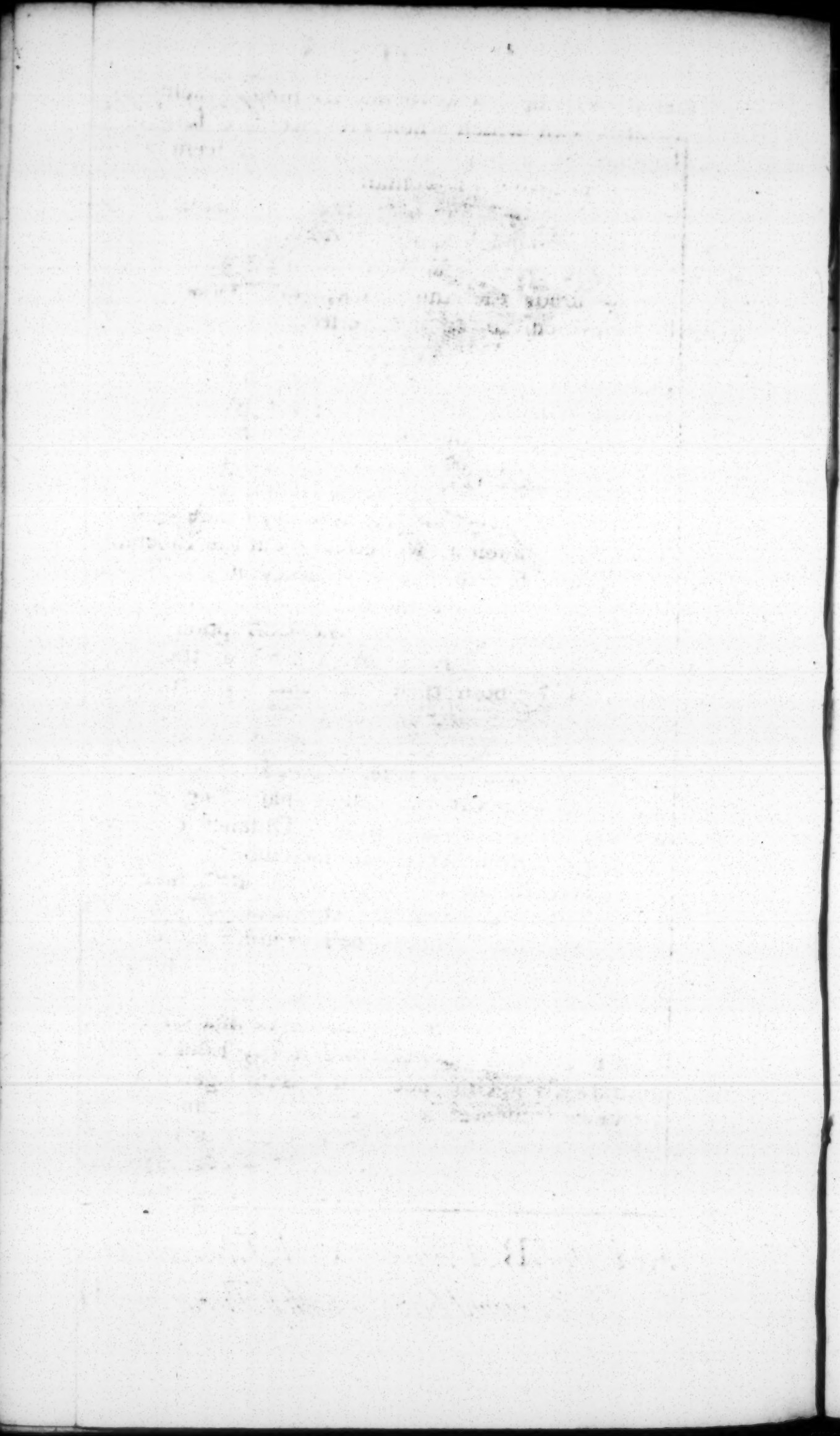
Let us continue to coast along the Shore, and approach one of these Fishers, to see what has been caught. In an Element which produces nothing, one would not imagine, either the Number or Fecundity of the Inhabitants to be very considerable. All that I behold surpasses my Capacity, and my Reason is still contradicted by Experience.

Shell-Fish. I observe a Set of Fishermen, who contrary to my Expectation, have taken an infinite Number of Muscles, Crabs, Lobsters, and other Fish of a monstrous Size: I discover Piles of Oysters, whose Whiteness and Fat excite my Appetite.

Flat Fish. I perceive other Fishermen who empty their Nets, and obligingly present us with a Profusion of Turbots, Flounders, Dabs, Burts, Plaice, and all the Species of Flat Fish, whose Flesh is so exceedingly esteemed. In another View, I take Notice of a whole Fleet of Ships loaded with Herring, and this is now the Season for that Fishery. * At other Times, instead of Herrings, there are Shoals either of



A. A Dab. B. A Turbot. C. A Flounder. D. A Sole. E. A Flying Fish. F. The Zygana, or Libella. G. The head of the Libella, viewed below, & with y^e Throat open. H. The Porpoise. I. The Narval or Sea Unicorn. K. The Sea Calf. L. The Tortoise. M. The Crocodile.



Mackerel or Whittings, who voluntarily present themselves on the Coasts, with which whole Provinces are furnished, by the Capture of a single Day. It should seem as if the Sea were incapable of containing the Treasures with which it teems. Legions of Smelts and Flounders quit the Sea in the Spring of the Year, and swim up the Rivers; Shads follow the same Track, and improve their Flesh to its due Perfection in the fresh Water; Salmon continue to the Month of July, and later, to enrich the Fishermen, sixty and even eighty Leagues from the Sea. Every Season regales us with new Pleasures; without interrupting the ordinary Presents they make us of * Lampreys, Smelts, Tunnies, Goldfish, Rockets, Soles, Thornbacks, and such a Variety of others, that garnish our Tables, and please every Palate. What a Delicacy and Profusion do we receive from the Liberality of this Element! But this very Delicacy might render them attainable by none but the Rich; or the Abundance might be so extraordinary, that the Corruption of the Whole, or the greatest Part, might prevent their Consumption by Man: Both these Inconveniencies are remedied by a little Salt. I see all our Fishermen employed in barrelling up their Herrings, after they have been salted. In the high Seas already appear the Vessels that bring us from Newfoundland, that is to say, from a Distance of near a thousand Leagues from hence, an incredible Number of Codfish preserved by this Precaution: In this manner the Sea loads us with its Bounties, and at the same Time, supplies us with Salt that facilitates their Communication, and secures their Conveyance: By which means, the Poor, who live at the remotest Distance from the Ocean, are also made Partakers of its Favours at a small Expence. I have no Expressions that can rise to any Equality with my Admiration and Gratitude. In this Prodigality of the Sea, I likewise discover a Precaution that enhances the Value of its Gifts, and proves a new Benediction to us. Those Fish who are wholesome and palatable, are extremely prolific, but those whose Flesh is disagreeable and

Smelts.

Shads.

Herrings.

* Bellon. de Aquatil.

pernicious, and whose enormous Size renders them formidable to others, are commonly viviparous; that is to say they bring their Young compleatly formed into the World, and have seldom more than one or two at a Birth: Of this Class are the Whale, the Dolphin, the Porpoise, and the Sea-Calf. The same Wisdom which has so advantageously regulated the Bounds of their Fecundity, removes far from our Shores those whom we have no Occasion for, and brings to our Nets all the Species most beneficial to us.

Whales, Porpoises, and all the great Fish whose Appearance would alarm and put to Flight those who nourish us, seek the high Seas, for fear of being driven on the Coasts, where they would be destitute of a sufficient Body of Water to sustain them. An invisible Hand impels them to those Parts that are abandoned by the rest, and prepares for them a Nourishment hitherto unknown, amidst the Ice of the North, and the Seas that wash the Coasts of *Greenland*; or it drives them to those Parts, in order to support the miserable Inhabitants, whom it would not totally neglect: These People eat the Flesh, and drink the melted Fat; and likewise employ the Bones and Skin in building, as well as the lining the Boats in which they fish.

All the other Species, on the contrary, come in Shoals to our Coasts, some are always with us, others swim yearly to us in vast Multitudes; the Time of their Passage, and their particular Track, are well known; Fish of Passage, and very singular Advantages are derived from that Knowledge. Let us form a Judgment of other Fish of Passage, by Herrings and Cod. The Nation of Herrings seem to have their Capital between the Points of *Scotland*, *Norway*, and *Denmark*. From that Situation, the *Danish* Colonies take their Progress every Year, and traverse at different Times, the Chanel, and after they have passed by *Holland* and *Flanders*, visit our *Neustria*. But however, these are not a Troop of *Banditti*, who coast about at random: Their Tour is prescribed, and their March yearly regulated, with the utmost Exactness. The whole Body begin their Departure at the same Time: None are permitted to straggle out of their proper Track; none among them desert

desert or commit Depredations: They continue their Progress from Coast to Coast, till the appointed Period: They are a numerous People, and the Voyage is long, and when the Body of the Army is passed, they are all gone, and none of the same Species make their Appearance 'till the next Year. Attempts have been made to discover, what induces the Herrings to undertake such a Voyage, and inspires them with the Policy they observe. Our Fishermen, as well as those of *Holland*, have observed, that the Chanel every Year teems with an innumerable Multitude of Worms and little Fish, on which the Herrings feed. They * are a kind of *Manna*, which these Creatures come punctually to gather up; and when they have intirely clear'd the Seas, in the Northern Parts of *Europe*, during the Summer and Autumn, they descend towards the South, where they are invited by a new Stock of Provisions; but if these fail, they proceed to accommodate themselves elsewhere; their Passage is more expeditious, but the Fishery less valuable.

Our Seas are but little frequented by Cod-fish; whose great Rendezvous is at the vast Bank before *Newfoundland*: There they keep their Festivals, and are so prodigiously numerous, that the Fishermen, who assemble there from all Nations, are employed from Morning to Night, in nothing but casting the Line, drawing up and embowelling the Fish, and fixing their Entrails on Hooks, to ensnare others. † One Man sometimes catches three or four hundred in a Day. When the Sustenance that allures them is exhausted in those Parts, they disperse and proclaim War against the Whitings, which they are extremely fond of: ‡ These fly before them, and we owe the frequent Returns of these Fish on our Coasts, to the Chace given them by the Cod-fish.

Now I have mentioned their Wars I recollect what has been told me of that which The Wars of reigns through all the Species: The Sole, Fishes. and most flat Fish conceal themselves in the Mud, whose Colour their Backs very much resemble,

* Leeuwenhoek Op. Phys. 42.

† Savari Dic. de Comm.

‡ Leeuwenhoek, ibid.

and are attentive in observing where the Females of the large Fish dig Holes for their Spawn; on which the Males afterwards deposite their impregnating Fluid, in order to render that

Their Generation.

Spawn prolific: The Sole immediately springs from her Ambuscade, and solaces herself with this exquisite Food, which contributes to fatten her, and gives her an admirable Flavour. The small Soles in their Turn, afford a Nourishment to the large Crabs; and as such kinds of Shell-fish seldom forsake the Gravel, where they search for the Spawn of Fish, there are scarce any Species of them, but what are sustained by this Sort of Food, and one can hardly open any of them, without finding one or two little Soles. You may judge of the other Species by this. I even suspect, that the minute Crabs that are found intire in the Generality of Muscles, and likewise the little Soles that are discovered in the Gills of some other Fish, are conscious of their extream Smalness, and are therefore solicitous to secure themselves a Shelter, in that Situation, from the Teeth of voracious Fishes.

All the Tribes of Animals who breed in the Water, from the largest to the least, are perpetually in Action, and at War; it is a constant Scene of Stratagems, Flights, Evasions, and Violence; they mutually plunder and devour one another, without Remorse or Moderation; in a Word, the Conduct of Fish resembles that of Mankind, and I am surprised that no one has been tempted to allow them the Faculty of Reason; but a more serious Thought occurs to me. If the Inhabitants of the Water are always upon the Watch, to make mutual Depredations on the scatter'd Spawn, and devour one another, this Element would in Time cease to be replenished, and indeed, had long ago been intirely depopulated; as the smallest Fish are a Prey to the stronger, those must have been all destroyed, and these in their Turn, would have perished for Want of Sustenance, but nothing can be more frivolous than the Criticisms made by Man on the Works of God; he has provided for the Preservation of Fish, by giving Strength to some, and to others Activity and Circumspection; and by multiplying them to such an astonishing Degree, that their Fecundity exceeds their natural Impatience to devour one

their Fecundity.

one another*; and those who are destroyed, are infinitely less numerous than the Survivors who recruit the Species. As great as the Number of Cods may be, that have been consumed by Man this Year, or devoured by other Fish, what remains of that Tribe, is always more than sufficient to furnish us with the same Quantity, a Year or two hence. And this is the Demonstration: When I went to view the Port of *Dieppe*, they brought us a very fine Cod, but much inferior to those we receive from the great Bank, I was curious to count the Eggs she contained; in order to which, I took as many as weigh'd a Dram, and three of us engaged to number them; we agreed pretty well in our Account, and then writ down the Total of the whole Dram; after which, we weighed all the Mass of Eggs, and repeated eight times the Sum of one Dram for every Ounce, which contains eight Drams†. The Addition of all these Sums, produced a Total of nine millions, three hundred forty-four thousand Eggs.

Countess. I don't pretend to compute after the *Prior*, and have no Difficulty to believe what he says, as incredible as it may at first appear. A common Carp is far from having such a Number of Eggs as a large Cod; but for all that, the Quantity is so amazing, even at the first Glance, that it contributes very much to justify your Calculation. All you have related astonishes me extremely, and gives me likewise an Inclination to meditate, or in other Words, to reason. When we are curious to know what may be the End or Intention of this prodigious Fruitfulness, 'tis certainly not to stock the Rivers and Sea, with as many Fishes as there are Eggs, for if it was, I am apt to think the Basin of the Ocean itself would not be sufficient to contain them. But we see there is a double View in this Fertility; one, to preserve the Species, midst all Accidents that may happen, and the other, to accommodate the Fish with a plentiful and juicy Food.

Chevalier. At present, I see, in some measure, how Fishes are enabled to live in the Water, and preserve their Species. I there discover Shell-fish, Worms, Eggs,

* Explic. de l'ouvrage de six Jours.

† Læwenhoek, Ep. Phys. 20.

Roes, and small Fry, in such an extraordinary Abundance, that I am no longer in pain for the Accommodations of the Table. The Inhabitants of the Water have a sure Allowance; but their Food conceals itself, and flies from them; and I discover nothing in Fishes, besides a Head, a large immoveable Body, and a Tail. How are they able, with so few Organs, to advance, swim, and launch on their Prey? There is likewise another Circumstance, in which I am entirely lost. Before I threw my last Carp into the Water, I took a Pair of Scissars and cut his Fins, upon which I imagined he would be incapable of swimming any more; and yet the Fish shot away, and darted up and down; but was always turned, either on one of his Sides, or with his Back downwards, whereas all the others swim on their Belly.

Countess. The poor *Chevalier* will have no Sleep to-night, if these Difficulties be not cleared up.

Count. I shall let you know, my dear *Chevalier*, in what manner I conceive all these Operations practicable. The

The Figure of a Fish. Figure of all kinds of Fish, as it perpetually tapers a little at the Head, qualifies them for traversing a Fluid. The Tail, by the

The Tail. Assistance of its Muscles, is extremely flexible, it is furnished with great Strength and Agility, inclines to the Right and Left, and,

as it recovers itself into a strait Line, repels the Water behind it; after which it immediately bends to the Right and Left, and, by this alternate Impulse, advances the Head and all the rest of the Body, in an infinitely better manner than that by which a progressive Motion is communicated to a Boat, by an Oar placed at the Stern, and work'd about alternately to the Right and Left. The

The Fins. Fins, which are inserted under the Belly of the Fish, contribute likewise, in some Degree, to repel the Water, and put the Body

in Motion; they also cause it to stop, when they are extended by the Creature, and cease to play to and fro; but their chief Function is to regulate the Motions of the Body, by positing it in an Equilibrium, so that if the Fish only moves the Fins on her right Side, and brings those on her left close to her Body, all the Motion is immediately determined to the left: Just as a Boat with two Oars, when only

only one of them is employ'd, will always turn to the Side to which it is impelled by the other. Deprive the Fish of these Fins, the Back, which is heavier than the Belly, being no longer kept in a due Poise, will slant on one Side, or be quite inverted; and this happens to dead Fish, who rise to the Surface of the Water with their Fins uppermost.

Chevalier. I fancy, my Lord, I comprehend a little, how the Tail of a Fish, in a direct Position in the Water, is capable of striking on one Side and the other; this is sufficient to give the Body a progressive Motion. But this Tail, which has very little Thickness, can neither impel the Water upward or downward: And therefore I cannot see how the Fish is able either to mount or descend.

Count. I expected that Question, and have an Answer prepared in this Paper. Do you know, Sir, what I now shew you?

Chevalier. 'Tis the Bladder of a Carp. Who has not jump'd upon it once in his Life?

Count. The Generality of Fishes have one like this, or something equivalent. We see The Bag of Air. it every Day, but give it a very equivocal Name; and indeed the Use of it is very different from what is commonly imagined*. This pretended Bladder is a Bag of Air, which enables the Fish to rise and sink, in proportion to its being dilated or contracted.

Nothing is easier to be comprehended, and a little Attention will make you Master of the Fact. In the first Place, lay it down as a certain Principle, equally agreeable to good Sense and Experience†, that a Body swims on the Water, when it is not more weighty than that Quantity of the Fluid whose Place it possesses. If a Board, whose square Surface contains two Feet, and its Thickness as many Inches, is equal in Gravity to a Body of Water of the same Dimensions, it swims on the Superficies; and if it be but half as heavy, no more than half its Thickness will sink into the Water: But should this Plank be more compact and

* Borelli de Motu Animal.

† Transact. Phil. n. 114. 115.

weighty than a Mass of Water of the same Depth and Surface, it will descend to the Bottom.

In the second Place, the less Air a Body contains, and the more compact it is in its Parts, the greater is the Gravity it acquires; on the other hand, it proves lighter, in proportion to the greater Multitude of its Pores, and the larger Quantity of Air it contains. A Bottle filled with Liquor sinks in the Water, because the Liquor and the Bottle together weigh more than a Mass of Water of the same Bulk; but the same Bottle, filled with Air, floats on the Surface, because both the Air and the Bottle have less Gravity than the Portion of Water whose Place they possess. In a Word, all Bodies sink in the Water, when they are not in an Equilibrium with the same Dimensions of the Fluid in which they are immersed.

Taking this for granted, the Body of a Fish, which is heavier than the Quantity of Water whose Place it fills, must always descend to the Bottom; and this would be the unavoidable Consequence, if the Fish had not in his Entrails a Vessel filled with Air, which enables him to sustain himself in what Part of the Water he pleases: This Vessel swells the Fish a little, and enlarges his natural Dimensions, without making any Addition to his Weight: which is a Circumstance that deserves a particular Consideration; for, by these means, he takes up more Space than he could possibly fill without the Vessel, and this brings him to an Equilibrium with the Mass of Water, whose Place he occupies. I will make a Supposition, that the Fish, without this Vessel, weighs sixteen Ounces, and that the Water, whose Place he fills, weighs no more than fifteen; the Fish must in this case infallibly sink. But if you then place in the Fish a little Bag of Air, which makes no Addition to the Animal's Weight, but only enlarges its Body; this will then possess more Space. If the Water then, whose Place he takes up, should weigh sixteen Ounces, the Creature is in an Equilibrium with this Quantity of the Fluid, and will then be sustained in any Part of the River where he happens to find himself.

Chevalier. Hitherto all goes very well. The Fish is in a Capacity for swimming, and can advance in one and the same Line. But your Lordship does not inform me, by what means he rises and sinks.

Count.

Count. Were he capable of enlarging his Vessel or Bag, what would be the Consequence? Take a little Time to consider that Circumstance.

Chevalier. Could he enlarge the Bag, his own Body would be larger, without any additional Weight. I comprehend that, my Lord. As he possesses the Place of a greater Mass of Water than he did before, he must certainly be lighter than that Water.

Count. You have not said all. If he becomes more light, he will ascend. And, on the contrary, if the Fish contracts the Bag, what will be the Consequence then?

Chevalier. He will diminish in Bulk, and fill up less Space, without losing any Degree of his Weight; by which means he must be heavier than the Water whose Place he takes up, and will consequently descend. But it seems improbable, my Lord, that a Fish should be able, every Moment, to contract and dilate this Bag, according as he has Occasion to rise or sink.

Count. This, however, he is obliged to do; and 'tis a Fact that has been demonstrated by unexceptionable Observations.

Chevalier. How is it possible for the Fish to have the Air at his Command in the Water?

Count. The Water abounds with Particles of Air diffused thro' the whole Mass. * What we commonly call the Gills of a Fish, are no more than a kind of Lungs, which he opens for the Reception of Air, and which have such a Mechanism in their Structure, that this Element is admitted without any Intermixture of Water. Thro' these Passages the Air evidently flows into the Bag, and then the Fish ascends: But, in order to sink, it is only necessary for him to contract the Bag; the Air then rises to the Gills, and is ejected, and the Fish descends with a Rapidity proportionable to the Quantity of evacuated Air. However, it must be acknowledged, that if several Facts demonstrate that Fish can breathe, and receive, as well as eject, some Bubbles of Air; yet the Conveyance of this Air into the Bag is not a very easy Operation, or capable of being immediately accomplished; I should therefore be of Opinion, that the Muscles of the Fish are his usual Expedients

* Hist. de l'Acad. des Scienc. 1711.

for contracting or enlarging the Bag; when he expands them, the Air is dilated by its natural Spring, and the Bag swells; when he contracts them, the Air is compressed, and the Bag shrinks.

Chevalier. What his Lordship has related seems to me very curious, and I am persuaded is all justified by Experience. I design to be convinced of the Fact by an Experiment of my own, and shall order the Cook to prick the Bladder of one of my Carps, to let out the Air; the Fish will not die immediately, and I shall see if he will sink to the Bottom.

Count. You will do very well. I love young People who are early in making Experiments and Reflections; by these means they form and cultivate their Judgment, and nothing is more sure and important in philosophic Enquiries, than seeing with your own Eyes. But as to your intended Experiment, I have formerly made it myself. You have seen, in my Closet, a Machine called an Air-pump, and which extracts the Air out of a Crystal, or any other Vessel that covers it. I one Day clapped in a living Carp, and when the Air was pumped out of the Vessel, I presently imagined, that the other Air, which remained in the Bag of the Fish, would be dilated, because that Element is perpetually making Efforts for its Enlargement, and there was then no external Air to gravitate on the Carp. The Affair succeeded to my Expectation; the Air, expanding itself in the Bladder, swelled the Fish to such a Degree, that his Eyes started out of his Head, and the Bladder at last burst in his Body: The Carp did not die, and I threw him immediately into the Water, where he continued to live a Month longer.

Chevalier. But he could not rise any more in the Water.

Count. Very true; and therefore he crawled along the Bottom of the Pond like a Serpent*.

Countess. This Bag of Air really produces surprising Effects. But your Fish must certainly be great Philosophers, to know the just Degree to which they ought to swell and contract themselves, in proportion to their intended Elevation or Descent, and to be able properly to open or close the

* Borelli. *ibid.* Propos. 29. Lowthorp's Abridg. Vol. II. p. 845.

Air-vent, as well as extend their Muscles, suitable to any particular Degree of Ascension in the Water.

Count. Our Reasoning must submit to Experience. But this Difficulty is sufficiently solved, by considering, that the Fish perform all these Operations without any Consciousness of what they do; and the Exactness of their Execution, instead of discovering any Knowledge or Attention of the Animal in whom they are transacted, only manifests the unsearchable Wisdom of the Almighty Creator of all Things.

Prior. With respect even to ourselves, whom God has endued with Reason for the Regulation of our Actions, what a Number of Functions are carried on without our Participation? We breathe, without knowing either the Structure or Use of the Lungs; and how many People are even ignorant they have any Lungs at all?

Count. We leap, we dance, and throw ourselves into a Variety of Gestures, without knowing either the Nerves we ought to extend, or the Muscles necessary to be swelled or relaxed, in order to accomplish such Motions.

Countess. I am not fond of Disputations, for I think they give one a disagreeable Character; but let me desire you, Gentlemen, to explain to me one thing that seems inconsistent with what you have advanced. I may speak of what occurs to me every Day. Have we ever discovered any Bag like this in Lobsters, who live in the Water? Is any Thing of this Nature to be seen in Crabs and Tortoises, who expatiate in that Element in full Liberty? I am likewise of Opinion, that it is not possible to make this Discovery either in Soles or Plaice, or any other flat Fish.

Count. We need not look for such a Bag in these Creatures, they have it not, and indeed it is altogether unnecessary*. River Crayfish, Oysters, Lobsters, and Crabs, never quit the Bottom of the Water, any more than Soles, and flat Fish; however, as the Weight of their Body is almost in an Equilibrium with that of a Mass of Water of the same Magnitude, they are capable of swimming a little, but without the Instrumentality of an Air-bag. The Fact is much the same with respect to

* Lowthorp's Abridgment. Vol. II. p. 845.

the Tortoise, for as she enjoys the Benefit of Lungs, she can distend herself by an Influx of Air, and be brought to an Equilibrium with the Water, like a Frog. She is also enabled to swim, like all other Amphibious Animals, by the Impulse and Retraction of her Paws; though for the Generality, she contents herself with creeping.

Chevalier. I have indeed taken Notice, that the Creatures of this Species, who are here in the Bason where I have lodged my Fish, never swim, but crawl on the Earth, in the Water as well as out of that Element. One may see them ascend from the Bottom, by the Aid of a Plank, and then take a Circuit on the green Turf that surrounds the Bason; after which they make a slow Return into the Water. This is an Amphibious Animal, of a different Structure from the rest. I wish his Lordship would just acquaint us with the several Species of this Creature, that are of any singular Use to us. For Instance, are the Tortoises in the Bason, the same with those whose Shells are used for Snuff-boxes and other Toys?

Count. They may serve for such Purposes, but the Tortoises you see here are small and very common. There are four or five Species of these Creatures, the most valuable of which are the * *Turtle* and the † *Carret*, as they are called: The former of these has not a very extraordinary Shell, but its Flesh and Eggs are very much coveted by Navigators, who find them an excellent Refreshment, as well as an infallible Cure for several Indispositions in long Voyages. A single Tortoise of this Species may produce two hundred Pounds of Flesh, which the Sailors take care to salt, and near three hundred Eggs, which are very large, and will keep for a considerable Time.

The † *Carret* is a very large Tortoise; as well as the other; his Flesh indeed is not so delicate, but he is much sought after for the Beauty of his Shell, which is fashioned as the Workman pleases, by softening it in warm Water, after which it is clapped into a Mould, whose Impression it immediately receives, by the Assistance of a strong iron Press;

* Rondellet, lib. i. c. 10.

† Diction. Savari.

‡ Ibid.

they

they afterwards polish and adorn it with Chafings of Gold and other Embellishments.

Chevalier. Before we quite the Article of Tortoises and Lobsters, I would fain know in what manner they live; for if they don't swim I should imagine their Prey might easily escape them.

Count. Lobsters and Crabs are furnished with a Couple of strong Claws, with which they fasten on the larger Prey, that inconsiderately happens to be near them. They search the Beds of Slime and Gravel for Worms, who there make their Retreat; they draw them out of their Lodgments with their little Pincers, and find a Collation ready prepared. As for the Tortoise, she feeds on Grass and Weeds, in the Water as well as on the Land. She makes her usual Residence, and finds her Aliment in certain Meadows, at the Bottom of the Sea, near several of the *American* Islands. The Water is not many Fathoms deep in some of those Parts; and according to the Relation of * Navigators, when the Sea is calm, and the Weather serene, the Tortoises are seen creeping on this green Carpet, at the Bottom of the Sea. After they have fed sufficiently, they take their Progress into the Outlets of Rivers for fresh Water; there they take in a refreshing Air, and then return to their former Station. In the Intermision of their Feeding, they generally float with their Heads above the Surface of the Water, unless they are alarmed by the Motions of any Hunters, or Bird of Prey, in which Case they suddenly plunge to the Bottom. They make yearly Visits to the Shore, where they lay their Eggs in Cavities in the Sand, a little above the Edge where the Surges beat, and cover them very lightly, that the Sun may communicate to them a gentle Warmth, and hatch their Young; whilst they are making Preparations for their Family, they furnish Mankind and Birds with a very plentiful Provision; for they lay their Eggs thrice, at the Expiration of every fifteen Days, and generally produce fourscore or ninety, or even more, at each Fecundation.

At the Conclusion of about twenty-five Days, the young Tortoises are seen to rise out of the Sand, and, without any Guide or Instructions, march with a gentle Pace to

* History of the Buccaneers.

the Water, but the Waves unfortunately throw them back on the Shore for the first few Days and then the Birds dart upon them, and carry off the Generality, before they have sufficient Strength to make proper Efforts against the Surges, and dive to the Bottom. So that out of three hundred Eggs, it is but seldom that more than ten escape, and sometimes they are all destroyed.

Countess. It should seem, at the first View, that Nature, in this Instance, charges herself with an unnecessary Expence, or is even imperfect in her Operations. But the Falshood and Injustice of such an Opinion is immediately evident. We never find ourselves disposed to complain of the Fertility of the Hen, who frequently presents us with three hundred Eggs in a Year, when not one Chicken is permitted to be hatched. We are very sensible, that the Intention of the Author of Nature, in this admirable Prolificness, is to facilitate the Preservation of the Species, and, at the same Time, to accommodate Man and other Animals with an excellent Food: So that nothing in the Works of Nature is either lost or defective; and particular Advantages are derived even from the Slowness of a Tortoise's Motions; for were she more expeditious, what a Number of Animals would be frustrated of their Food?

Prior. Let us proceed in our Examination of the various Benefits we receive from the different Species of Fish, and we shall discover, thro' the Whole, new Motives to adore him who has replenished the Water, as well as the Earth and Air, with all Sorts of Blessings.

Count. Those very Fish who are disagreeable to our Palate, are nevertheless not unprofitable to Man. We have already observed, that Northern Fish, whose oily Taste is offensive to us, afford a Sustenance to other People, whose Necessities they can better accommodate. The very Fins, the Scales, and most inconsiderable Parts of these Animals, are extremely serviceable to several Nations. There is one Species of Fish, whose Fins are so very strong, that the Inhabitants of *Greenland* use them for sewing the Skins of Bears, which furnish them with their Dress, and which they tack together with Strings made of the dried Entrails, which serve their Purpose instead of Thread.

The

The same People build the Hulls of their Vessels with the Bones of Whales, and afterwards line them with the Skins of Sea-Calves, or Whales themselves. A Man sinks half his Body into the Hollow of one of these Boats, and sits with his Feet extended at the Bottom, and the Extremity of his Coat of Skins perfectly covers the round opening in which his Body is fixed. The *Greenlanders*, with their left Hand, work a little Oar, or Paddle, ending with a double Blade, and arm their right with a Harping-iron; and with this Equipage swim very lightly on the Water, braving the Tempests, and assaulting the Whales and Purpoises that afford them their Subsistence. These Boats are more serviceable, safe, and expeditious than our own.

Chevalier. For what Reason then do we make no use of them?

Countess. Would you have it said, that the *Europeans* are instructed in any Particulars by the Inhabitants of *Greenland*? You know we have all the Knowledge to ourselves.

Count. There is a Fish in the Northern Seas, from which the *Muscovites* extract a Glew that is extremely beneficial; it clarifies our Wines without the least Diminution of their Goodness, and never communicates to them any Quality of its own: Our Manufacturers use it to strengthen and polish the Warp of their Works; and it is frequently employed with Success, where even strong Glew will not stick.

The *Danes* and other Northern People catch a very large Fish called a *Walruis* or *Narwal*, whose Teeth are more esteemed than those of the Elephant, because they are an Ivory of the purest Whiteness, and not subject to grow yellow. The left Jaw of this Creature is armed with an Ivory Horn, extending sometimes to a Length of fourteen, fifteen and sixteen Feet: These Horns are to be met with in the Cabinets of the Curious, and have been thought to belong to the Unicorn †,

† The Unicorn is an Animal very different from the common Idea of him. See Bochart's *Hierozoic*.

who is an Animal intirely chimerical, or at least undiscovered by the Moderns, whatever Knowledge of him might be among the Antients.

But of all the Species of Fish, who are never brought to our Tables, the Whale is undoubtedly the most beneficial: It is an Animal of a stupendous Size, an hundred and thirty, an hundred and sixty, and sometimes two hundred Feet in Length, and extremely profitable to those who engage in that Fishery.

Chevalier. How is it possible to conquer such a monstrous Creature? He must certainly rend and destroy whatever comes in his way.

Prior. The Fishery is exceedingly curious, and I will give you the Description of it in a few Words. This Creature is found in the most Northern Parts of *Europe*, which are resorted to by a great number of Vessels, appropriated to that kind of Capture. When a Whale makes his Appearance on the Water, the most vigorous and bold Fisherman takes a Harping iron, which is a Javelin well steel'd at one Extremity, and five or six Feet long, and to which is fastened a Line of above an hundred Fathoms in Length. When once this Instrument has been darted into the Fat and Flesh of the Whale, the Affair is all over, and the large Animal plunges to the Bottom, and the Harpooniers let the Line run out very quick. When they have not a sufficient Quantity, to enable them to pursue the Fish in its Career, they fasten to the End of the Line a Gourd, hollowed within, and well closed up, and carefully observe its Motion, that they may find the End of the Line, and know where the Whale conceals himself. The Creature, after losing his Blood, sometimes rises to the Surface of the Water, or else they drag him up with the Cord; they then endeavour to get him into their Possession, draw him to the Shore, and cut him in Pieces.

Chevalier. If the Flesh be not eaten, to what other Use is it applied?

Prior. The Fat of a small Whale, about sixty or seventy Feet

Feet long, sometimes produces an hundred Casks of Oil; and a Whale of two hundred Feet in length, generally yields sixteen or twenty Tons.

Chevalier. What may this Oil be good for?

Prior. It furnishes a very considerable Trade: They use it in dressing certain Skins, and it thickens the Pitch, with which they kalk Ships; they likewise dress Wool with it; and it proves a necessary Ingredient in Soap: It is even employed in Painting and Physick: But it is more especially of infinite Use in the North, where it furnishes a frugal Light, in the long and dismal Darkness of those Regions.

Countess. Do these great Fishes supply us with the Whalebone which we purchase of the Merchant?

Count. The Name of Whale is given to two sorts of Fish; one is small, furnished with Teeth, and his Brain produces that white Substance called *Sperma Ceti*, so much esteemed by the Ladies. The other is the large Whale, who is destitute of Teeth, but then he is supplied with two large Tusshes, a dozen or fifteen Feet long, which rise out of his Jaws, and conveniently enable him to amass together the Weeds, which are generally supposed to be his Food, because Quantities of them have been found in his Stomach. These Tusshes, split into small Divisions, are the pretended Whalebone, or that strong and pliant Substance we buy of the Merchant under that Name; and whose present Usefulness seems almost confined to the Hoop-petticoat; a Mode of Dress altogether senseless and unamiable, but which the Ladies have taken a Resolution to continue, because they think it gives them less Constraint than the Dress they have now disused.

Countess. What does your Lordship mean? In Matters of Mode, the weakest Heads prescribe Rules to the wisest. But let us not wander from our Subject. These great Whales put me in mind of an amphibious Animal above an hundred Feet long, and with whose Description you entertained us the other Day.

Count. You mean the *American Crocodile*.
Crocodiles. But I would not give too much Credit to the Relations of old † *Spanish Travellers*, who are very apt to enlarge in their Descriptions. The Crocodile who lives in the *Nile*, the *Niger*, and some other Rivers of *Africa*, has no such Length; some of these Creatures are fifteen, eighteen and twenty Feet long, but they very seldom exceed twenty five; which is a Length sufficient to give the Animal a very monstrous and formidable Appearance.

Chevalier. Is not this the Animal who resembles a large Lizard, and has Jaws armed with Teeth, ranged like those of a Saw, and a Body and Tail covered with large impenetrable Scales, and who, according to the Accounts given of him, very artfully seizes young Children, when he discovers them on the Banks of the River in which he lyes concealed?

Count. The very same.

Prior. This Animal, were he too prolific, would reduce Mankind to the greatest Desolation. But God has prepared for him a couple of Enemies who are always contriving his Destruction: And these are the *Hippopotamus*, or Seahorse, and the *Ichneumon*.

The *Hippopotamus*. The *Hippopotamus* § is a very large amphibious Animal, who lives at the Bottom of the *Nile* and *Niger*, from whence he rises, not by any Effort of swimming, but by crawling with his four Feet, when he goes to feed in the Meadows, or even on the Tops of Mountains: He grazes in the Herbage, and then returns to his Station in the Water, where he is in a perpetual State of War with the *Crocodile*.

The *Ichneumon*. The *Ichneumon* is a Water-rat, or little Ferret, and the *Crocodile's* great Terror. Some Travellers assure us, that he creeps

† See the Leviathan of Samuel Bochart, Hierozoic. lib. 4.

§ See the Behemoth of Bochart, Hierozoic. lib. iv. c. 15. 16.

down that Creature's Throat when he is asleep, devours his Entrails, and kills him with extreme Pain; after which, he feeds on him at leisure. Others inform us, that they are unacquainted with this Fact, but have frequently seen the *Ichneumon* throw himself on the Eggs; left by the *Crocodile* in the Sand, and which he destroys to the utmost of his Ability.

Count. If the *Chevalier* has any Curiosity to see the Figures of the *Crocodile*, the *Sea-horse*, and *Ichneumon*, comprehended in one Piece of Sculpture, he must go to the *Tuilleries*.

Chevalier. To what particular Part, my Lord?

Count. Have you never taken notice of a Statue that represents the *Nile*, with fourteen other Figures of its young Offspring?

Chevalier. I have frequently seen it, without comprehending any Part of the Statuary's Intention: Pray, what may be the Signification of all this Progeny, and the Figures that are round the Pedestal?

Count. The fourteen Children of the *Nile*, some of whom are placed above, and others below, are the Symbols of the different Risings of that River, which are extremely beneficial to *Egypt*, when they ascend to the Height of fourteen Cubits; and the Country is threatned with Famine, when they have a less Elevation: If the River swells to fifteen Cubits, a great Plenty infallibly succeeds; but when it rises to sixteen, the Consequence is intirely different. Fourteen Cubits are the necessary Standard. Under the Figure of the God of the *Nile*, leaning on his Urn, is a large Bed of white Marble, round which you will see in *Relievo* the Objects peculiar to *Egypt*, such as the *Lotus*, a Plant with which the Inhabitants make a kind of Bread, or broad thin Cakes; the *Ibis*, a kind of *Stork*, who purges the Country from Serpents; and the *Ichneumon* and *Sea horse*, combating the *Crocodile*.

Countess. Gentlemen, I have permitted you this Day to discourse on every Subject you thought proper ; but I intend to make a better Use of my Prerogative as President, and shall recal you to those Subjects that are more suited to my Capacity. I propose to the Company, for our next Conversation, the Article of Plants, with their Flowers and Fruits. Next to my Birds, this is the Subject wherein I have most Experience.



PLANTS.

PLANTS.

DIALOGUE XIV.

The COUNT, *and* COUNTESS. *The* PRIOR, *and*
CHEVALIER.

Countess. CHEVALIER, we make you a Proficient in all the Arts and Trades in their Turn. You have already gone through those of an Hunter, a Weaver, a Fowler, and a Fisher : To Day we shall teach you to be a Gardener.

Chevalier. Must we part with Animals so soon : There are vast Numbers of them who have never been the Subject of our Conversations. His Lordship, tho' he has no great Esteem for the Theatre of *Russian* Animals, permits me sometimes to view the Figures which are very numerous in that Work. I looked them over Yesterday, and did not see one new Animal whose Name, Residence, and Profession, I had not a Curiosity to know. I fancy it would be very entertaining to be acquainted with them all.

Count. This is the very Inclination with which I was desirous of inspiring you, and each Animal merits a particular Consideration and Study. The single Trunk of an Elephant

phant would furnish sufficient Matter for several Conversations: But we don't intend to exhaust every Subject, and fatigue you with too many Particulars; we only desire to raise in you an Inclination to these Amusements, and after we have made you sensible that much greater Advancements are practicable, 'tis proper to leave the rest to your own Examination.

Countess. But do you imagine, *Chevalier*, that we turn the Conversation from Animals, when we discourse of Plants? No, surely, for even these are a Species of Animals, who, tho' they don't move from Place to Place, have yet their proper Sustenance, and become Founders of a numerous Posterity, as well as those who march up and down.

Prior. What her Ladyship advances in a Vein of Pleasantry has a great Air of Truth. The Root, according to Observations, supplies the Plant with a Stomach for digesting the Nourishment; the Bark is a Skin which covers all the Vessels, the Stock is the Body of the Animal; and the Sap, which ascends from the Root to the Branches, and then returns from the Branches to the Root, has a perfect Conformity to the Blood that circulates in the Bodies of Animals.

Count. What is your real Opinion, Sir, of this pretended Circulation of the nutritive Juice? Are you persuaded it is Fact?

Prior. Every Circumstance seems to intimate the Affirmative; but before we undertake to discuss this Point, we should do well to consider the Origin of all Plants, and their essential constituent Parts; after which, we may proceed to the Manner of their Nourishment.

Count. I am willing we should pursue this Method. *Chevalier*, do you recollect the general Origin of all Plants?

Chevalier. They rise from Seeds.

Count. Do you believe then that the Earth cannot with its Heats and Juices form a Plant at once, without the Concurrence of Seed?

Chevalier. It cannot produce the least Blade
The Origin of of Grass. I remember your Lordship told me,
Plants. with Relation to Animals, that the Earth
nourishes every individual, but cannot form an
orga-

organized Body. The same Order and Design visible in Animals is to be discovered in Plants. The Juice of the Earth may indeed nourish a Plant, and that is the utmost of its Operation, but it cannot give it its original Existence.

Count. In Reality, if the Juice of the Earth could produce Plants, it must be endued with all the Omnipotence of the Creator, in order to give an instantaneous Existence to the Roots, the Ducts, the Fibres, the little Vessels appointed for the Reception and Distribution of the Sap, the Glands to filtrate and proportion it to the Delicacy of the Vessels into which they are admitted, the Vents or Spiracles to receive and diffuse the Air; in a Word, all the Parts of a Plant, as the Bark, the Wood, the Pith, the Buds of Branches, Flowers, and Fruits. This Juice must be gifted with Intelligence to be capable of such a Variety of Operations, and never by Mistake to cause one Plant to produce the Gems and Fruits of another Species.

Chevalier. I am not able to comprehend how any one can think the Earth qualified to form the Body of a Plant. I would as soon say, it had produced Mankind, and even the Moon and Sun.

Count. I am exceedingly delighted at your discovering the Necessity of resorting to the Agency of an Almighty Being. He indeed is incomprehensible, but without him it is impossible for any Thing to be intelligible. When his Interposition is once supposed, 'tis easy to conceive the Possibility of producing all Things. He alone was capable of forming the Matter which constitutes all Bodies, and none but himself could extract out of this Matter several Elements, each of which is perpetually the same, notwithstanding their different Combinations form an infinite Variety of Bodies. The Elements may indeed make mutual Approaches, and intermingle with each other, but the Result will be no more than a Heap of confused Masses; there will be neither Organs, nor Life, nor Soul. Let us suppose the Earth to be newly created, it will for ever continue naked and barren, if it be not arrayed and peopled by the Deity. He alone can organize Bodies, and animate such organized Species as Plants and Animals. The minutest Sprig of *Sorrel* or *Chervil* is formed, like all the rest of the Creation, by a particular Plan and a special Will.

As to the Manner of perpetuating Animals and Trees after their first Formation, the Deity might either determine to create more, whenever it should be necessary to substitute a new one in the Room of another that Age had decayed, or he might at once provide for all Successions of Ages, by inclosing in the Seed of the first Tree all its Posterity in Miniature; so that each Species must unavoidably produce its own Resemblance, and the Earth would be only charged with a Contribution of Juices necessary to nourish and unfold the Seed; and indeed this is the magnificent Order he has been pleased to establish. The Imagination is astonished to find Millions of Seeds involved in one another; but Reason teaches us to receive the Fact without Hesitation, because the Great Creator is omnipotent.

Count. Be upon your Guard, *Chevalier*, you will receive a brisk Attack from me. There are some Plants, such as *Mushrooms* and *Fern*, that don't exhibit any Seed to our View, and yet shoot forth daily, and grow in different Situations: God must therefore either create them anew, or the Juices of the Earth put into Motion are qualified for the Production of organized Bodies.

Chevalier. I don't know, my Lord, whether the *Prior* may be a Prophet, and knew four Days ago, that you intended to embarrass me with your *Fern*; but, however, he furnished me with the Answer I shall now give you. He directed me to place my Ear close to a Paper, where at first I was not sensible of any Noise, but afterwards heard a small Sound or Crackling, which made me very attentive to discover the Cause: And I then observed a Number of little Grains, skipping over one another, like Mites in a Cheese; but by the Aid of a Microscope, I had a very different View, for these Grains were a Parcel of Shells that contained a Quantity of Seed. The Dryness of these Shells made them crack, and the small Grains shot and dispersed themselves up and down. These were the very Seeds of *Fern*, and now your Lordship may tell me, if you please, that this Plant produces none.

Count. But you are silent as to the *Mushroom*.

Chevalier. Give me Leave to tell your Lordship, that you are not easily satisfied; were it true, that we cannot discover any Seeds in a Mushroom, I would still maintain it does not want them, though they are too small to be visible,
and

and so very light that they are wafted up and down by the Wind.

Count. The Fact is undeniable, if in this Particular we may judge of the Conduct of the Deity by that which he never departs from in ten thousand other Instances.

Countess. Every Plant is produced by Seed.

This is a Truth familiar to our Experience ; The Seed, but let us enquire into the Nature of a Seed, and what it discovers to our View. You, Gentlemen, who have examined these Particulars with your Glasses, can give us some Light into the Affair.

Count. We will begin with the external Appearance. All the Seeds of Plants have different Sheaths, which inclose them till they are lodged in the Earth: They are capable of being turned, measured, and heaped up, without the least Prejudice, because they are invested with a Covering and defended from Danger. Some of these Seeds, as the Kernels of Apples and Pears, are placed in the very Heart of the Fruit, whose Substance consequently performs the double Function of enfolding the Seeds whilst they continue tender, and nourishing Mankind, when the Seeds, in their State of Perfection, no longer want a Surtout. Others grow in Shells, and of this Sort are Peas, Beans, Lentils, Poppy Seeds, and Cocoa Nuts: A third Sort, beside their Inclosure in the Substance of the Fruits, are shut up in thick Shells of Wood, and of this Species are Walnuts, Almonds, Apricocks, Peaches, Plums, and other Kinds. Several, beside their wooden Shell, have likewise a bitter Rind, which is the Case of Walnuts, or a Covering thagged with Prickles to preserve the Seeds from all Injury, till they have completed their Maturity; Chesnuts belong to this last Class.

The Manner
in which Seeds
are enfolded
and covered.

Chevalier. I find that Fruits of a moderate Goodness have a Variety of Preservations; but in my Opinion, the Peach which is so excellent, is much more intituled to the Protection of a strong Shell; we should then enjoy it for a longer Season.

Prior. Give me Leave to tell you, *Chevalier*, that God is equally free and fertile in his Operations: He has furnished the Generality of Seeds with a Covering of Wood, and has not thought it proper to afford one of equal Strength

As to the Manner of perpetuating Animals and Trees after their first Formation, the Deity might either determine to create more, whenever it should be necessary to substitute a new one in the Room of another that Age had decayed, or he might at once provide for all Successions of Ages, by inclosing in the Seed of the first Tree all its Posterity in Miniature; so that each Species must unavoidably produce its own Resemblance, and the Earth would be only charged with a Contribution of Juices necessary to nourish and unfold the Seed; and indeed this is the magnificent Order he has been pleased to establish. The Imagination is astonished to find Millions of Seeds involved in one another; but Reason teaches us to receive the Fact without Hesitation, because the Great Creator is omnipotent.

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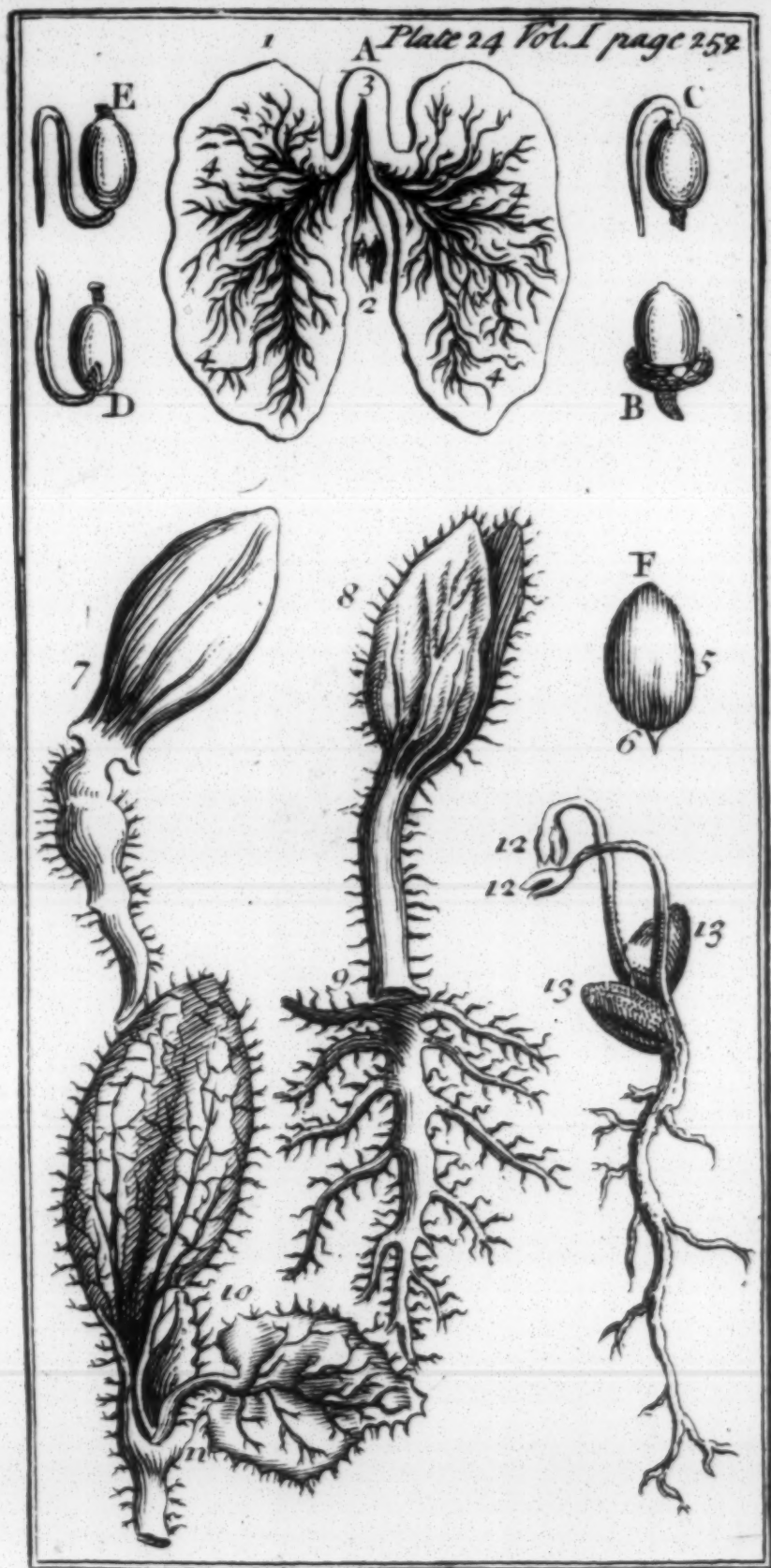
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Prior. Give me Leave to tell you, *Chevalier*, that God is equally free and fertile in his Operations: He has furnished the Generality of Seeds with a Covering of Wood, and has not thought it proper to afford one of equal Strength

to the Substance of Fruits, which in Reality is no more than a Covering or Defence to the Seed: He has inclosed some particular Fruits in a light Skin, others in a solid Bark: He alone fixes the Regulations, and is not subject to any Restraint. But though it be incumbent on us, only to celebrate his Choice of one Method in Preference to another, we may be sometimes indulged in a modest Attempt to discover the Reason of such a Proceeding. The Peach and Plum are appointed for our Refreshment at the Close of the violent Heats; in any other Season they would chill us, or at least be depreciated by the Variety of other Fruits. As therefore their Appearance is limited to a short Period, their Clothing is proportioned accordingly, and a simple Gause is sufficient. The Apple and Pear which are intended to succeed them, and continue even in the Winter Season, have received a more compact Array: For which Reason, Chestnuts, and other Species of Nuts that are to last all the Year, are still fortified in a better Manner. Chestnuts are the Food of whole Nations: But the little Birds would destroy them in their tender State, and therefore, to preserve them from such Insults, Nature has shagged their Out-side with Prickles; and perhaps intimates to us by such a Precaution, that they are capable of furnishing us with more considerable Advantages. Nuts are the Sustainance of several Animals as well as of Men: They produce an Oil proper for burning, and which likewise preserves our Paintings and other Furniture, and gives a Suppleness, Strength and Cohesion to Leather. The Walnut is delicious even in its State of Immaturity, and furnishes our Tables with a Regale comparable to the finest Peach. Such a delicate Food would attract all the Birds, and deprive Man of many Conveniencies, did not the bitter Flavour of the Rind prevent those Animals from piercing it with their Bills.

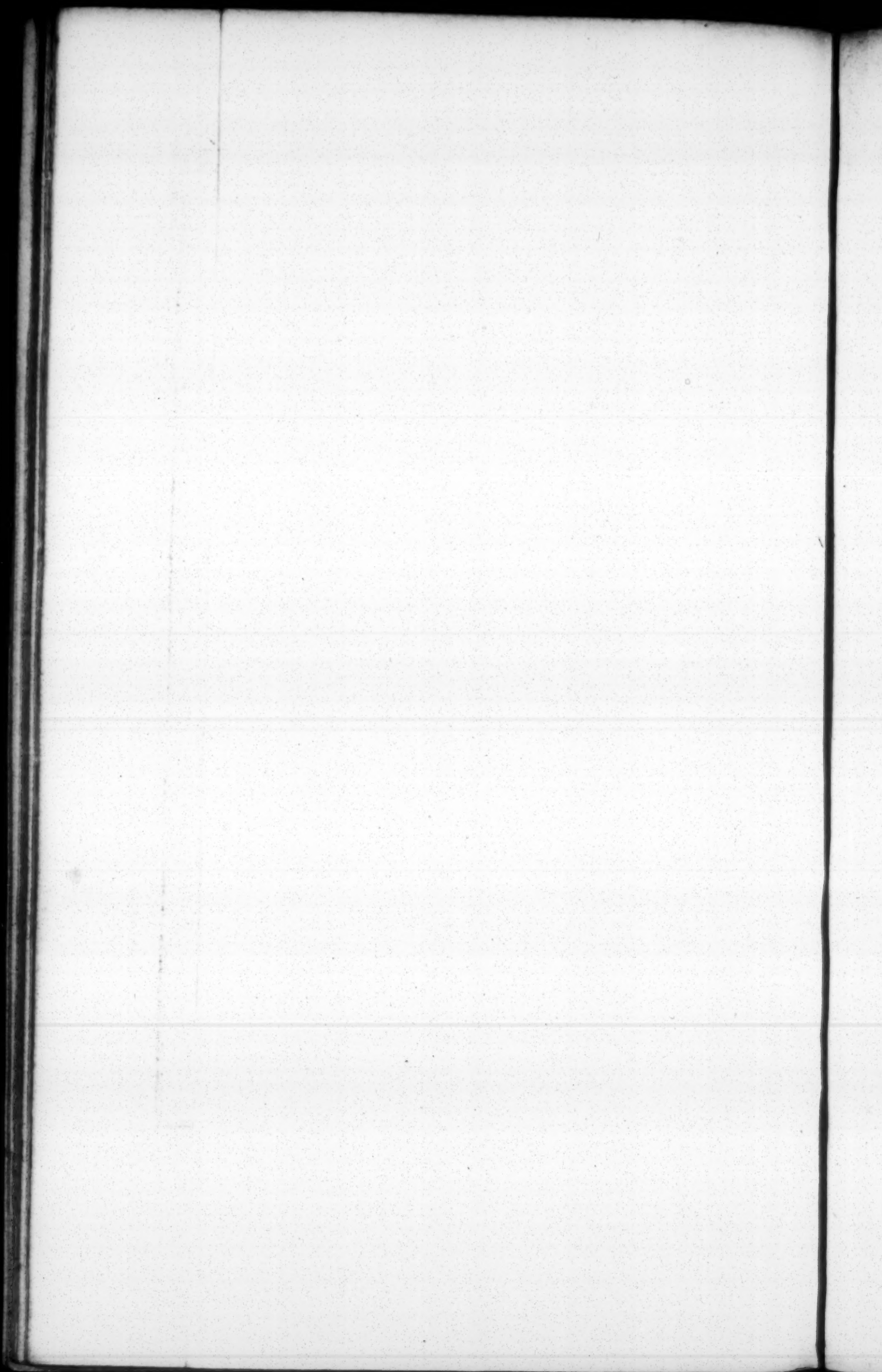
Count. Besides these outward Foldings' e-
 The Epider- very Seed has its Bag, and its *Epidermis* or
 mis, fine Skin, in which the Pulp and the Bud
 are involved.

We may form a Judgment of all other Seeds by the Structure of a Pea, a Bean, or the Kernel of a Melon: The Texture is very near the same throughout the whole. Take away the Covering which infolds a Bean or any other Seed you please, you generally discover two Pieces which part
 in



• A. Motte sculp. •

Seeds.



in your Hand, and are called the Lobes of the Seed: These are nothing else but a Composition of a Kind of Meal, and the nutritional Juice or Sap of the Earth, which form a Pap or milky Substance proper to nourish the Seed. The Lobes.

At the Top of the Lobes, the Bud is planted and sunk in like a small Stud. It is composed of * a Stock and a Pedicle, which last will afterwards be the Root. The Stem or Body of the Minute-plant, is sunk a little into the inward Substance of the Seed; and the Pedicle or small Root, is that Point which we see disposed to shoot forth the first, from the Foldage that encloses it. The Bud.

The Pedicle, or Tail of the Seed is fastened to the Lobes by two Bands, or rather branching Tubes, whose Ramifications are dispersed through the Lobes, from whence they are appointed to derive the Juices necessary to the young Plant. The Pedicle.

The Stock or Body of the Plant, is enfolded by two Leaves that entirely surround it, and keep it fixed as in a Box, or between a Couple of Scales.

These two Leaves are the first Parts of the Plant that disengage themselves from the Seed and the Earth, and are the Harbingers of the Trunk, the exceeding Delicacy of whose Texture they preserve from all Collisions that would prove injurious to it, and perhaps they may be serviceable in Instances of quite another Nature. As both these Leaves are, in many Plants very different from the true Foliage, and the first that rise from the Seed, to preserve the tender Infancy of the Plant, they are called the Seminal Leaves. There are some Seeds, whose Lobes extend themselves out of the Earth, and seem to perform the same Functions as the first Leaves. The Seminal Leaves.

After the little Root has been nourished by the Juices it extracts from the Lobes, it finds either in its own Inclosures, or else in the Skin of the Seed, a small Aperture which corresponds with its Point, and is discoverable by the Aid of a Microscope, in the Shell of the hardest Nuts, as well as in the Skin of The Root.

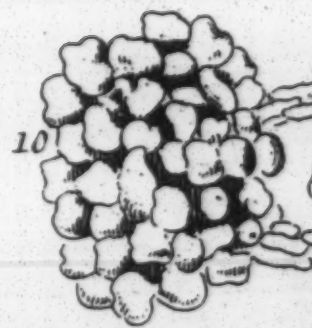
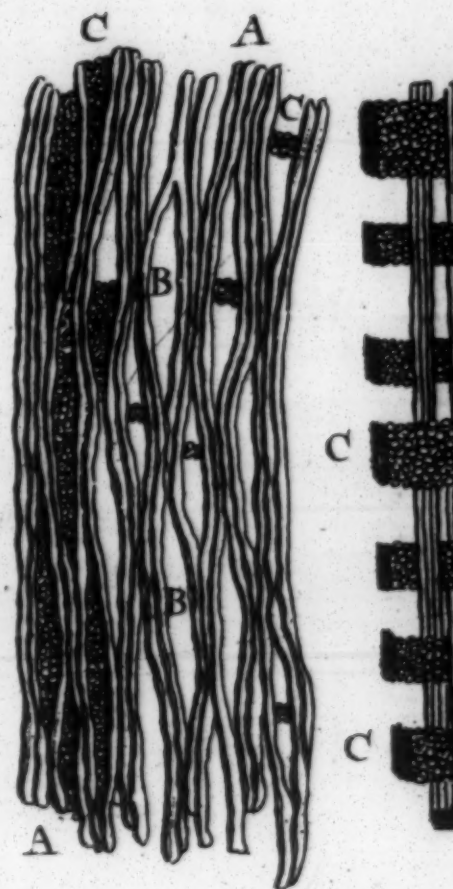
the Seed. Through this Aperture the Root passes, and shoots into the Earth several Fibres, which are so many Canals for the Conveyance of the Sap into the Body of the Root, from whence it rises into the Trunk, and gives it its Elevation in the Air. If the Trunk meets with a Mass of very compact Earth, it turns aside into another Direction, being unable to pierce through the first Obstruction, and sometimes bursts and dies for want of Force to proceed further: On the contrary, if it bears against Earth that is light and soft, and which Qualities it ought to receive from the Labour of the Gardener*, it then pursues its Way without any Impediment. The Lobes, after they have exhausted themselves for the Benefit of the young Plant, extract a Nourishment for themselves and then wither away: The same Fate attends the Seminal Leaves, which, by the Ministration of their Pores, imbibe from the Air a genial Humidity, and a Flow of Spirits that are salutary to the Plant, and when their Services are completed, they fade and die away. The young Plant, by the Instrumentality of its Root and Fibres, draws from the Earth more strong and copious Juices than it was at first supplied with by the Seed; it fastens itself more and more, and begins to unfold its different Parts, that before were rolled up and involved in one another. Let us now proceed to the Parts within.

The Pith. The Pith which is a System of little Cells, separated by Interstices or Partitions of a very thin Texture, is lodged in the Heart of the Trunk and Branches; and there great Quantities of Sap are discovered.

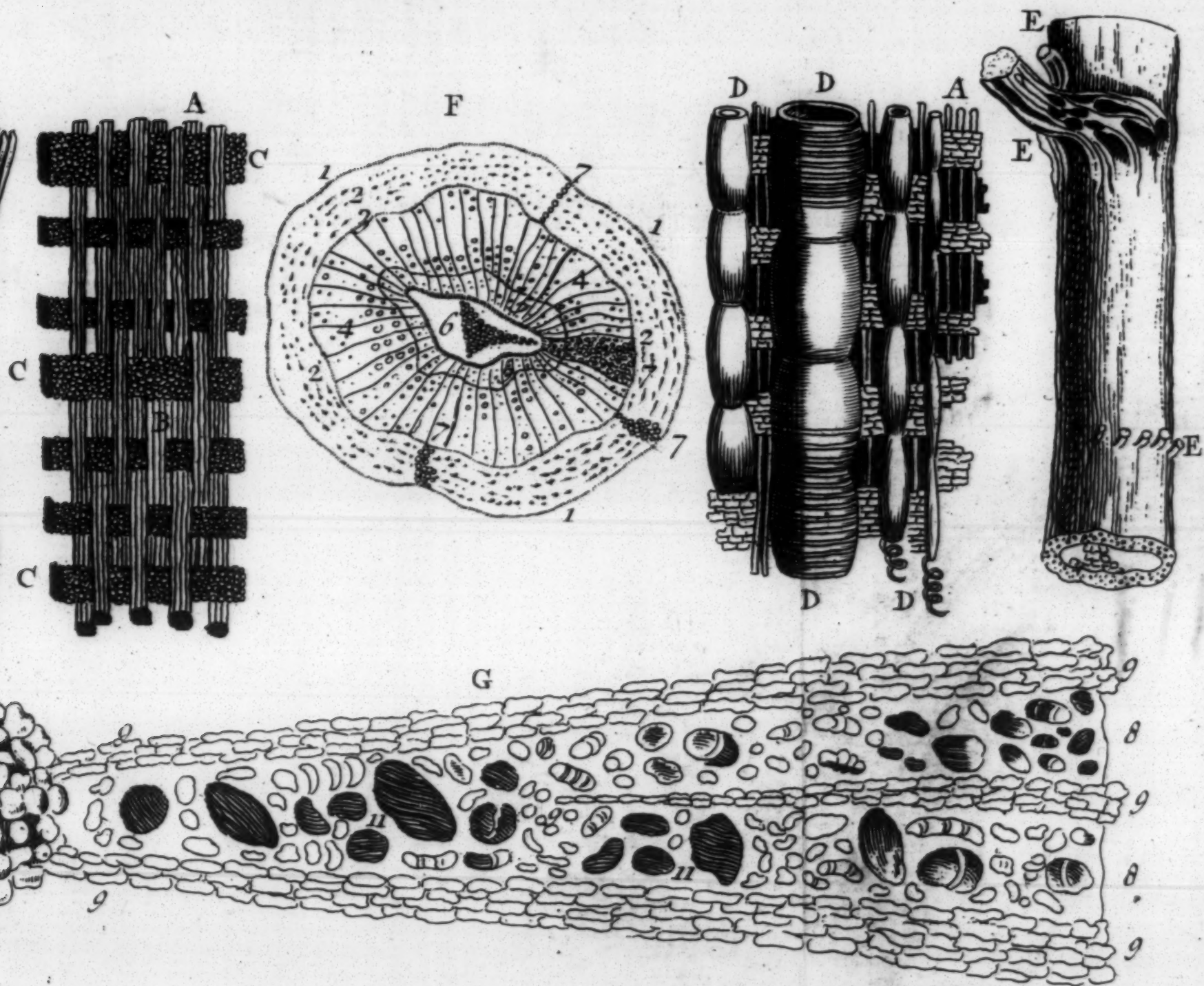
The Wood. Round the Pith a Multitude of hollow Fibres rise in lateral Ranges, disposed in Packets one against another. All these Packets ascend the whole Length of the Plant, and are compacted together by several Fibres, passing in an oblique Direction from one Range to another, and frequently crossing each other like the Figure of an X, or the Meshes of a large Net, in such a Manner, that these Fibres frequently admit of Spaces between them, which are sometimes in the Form of Lozenges, sometimes square, but generally oblong. This System of long Tubes that ascend round the

* Hoc imitatur arando. Virgil. Georg. 2.

Heart



A. Motte Sculp^t.



The Inward Substance of plants.

Heart form what we properly call the Wood, and are appointed to convey the Sap.

Round the Wood is another Assemblage of hollow Fibres, ranged almost in the same Manner, and these are called the Bark. There are three Parts to be taken Notice of, which differ from one another; the inward Bark or fine Skin, immediately contiguous to the Wood; the *Epidermis* or outward Skin, which is a Net extended over all the exterior Surface of the Tree, and the intermediate Bark or thick Substance between the two preceding Skins.

The fine Bark has a very singular Use in Trees: It seems to be a Collection of little Skins, or a Tissue of Fibres glewed over one another; the first inward Round of which disengages itself from the rest in the Spring, and adds a new Circumference to the Wood through its whole Length. Trees, like Insects and Reptiles, have several Skins folded over one another; but then Reptiles and Insects divest themselves of these first Skins, and entirely quit them to appear from Time to Time in a new Form and another Array; whereas Trees have annually a new Habit, but then it is cast over the preceding, the Bark serving for a Surtout. It is evident that the fine Bark furnishes the Tree with the Rounds of Fibres that yearly enlarge its Bulk, because when the large Bark, with that which is inward, is cut off in any Part leaving the Wood exposed to View, you must never expect that the Wood will receive any Augmentation there: Both the Bark and the Wood continue their Growth in the adjoining Parts, but the Aperture remains as it was first made, and can only be closed up in a long Process of Time, by the lengthening of the Protuberances formed by the neighbouring Fibres.

'Tis easy to distinguish these annual Accretions in Trees; one need only cut a Trunk or a large Branch horizontally, to discover the several Circles or different Degrees of Thickness round the Heart, and one may infallibly determine the Years of the Tree's Age, by the Number of Circles visible in the Wood: The last Revolutions are always of a lighter Consistence, and are called the sappy Parts of the Wood, which are rejected by the Workmen, as too weak to be any Way serviceable to their Purpose. These soft Parts contract

tract a Solidity in the succeeding Years, they likewise become more compact, and in no Particular differ from the real Wood. The Tree, by its perpetual Increase in Strength and Circumference, forces the Fibres of the Bark to stretch and extend themselves, and the outward Surface sometimes bursts with a surprising Noise ; this occasions the Crevices, which are always enlarging in the external Bark, in Proportion to the Growth of the Tree.

The Sap Vessels. We have observed, that the large Bark as well as the small, the sappy Parts and the real Wood, are composed of long Rows of Tubes or hollow Fibres, that ascend and join together, or have a Communication with one another by the Agency of transverse Fibres, and there must consequently then be several Spaces between these Fibres : All these Kinds of open Meshes are filled with little Vessels or Bags of an oval Form pierced at the two Extremities, and joining to one another at each End like a String of Beads, ranged at the same Time in Heaps one above another, and extending in an horizontal Line from the outward Bark cross the other two, and the Wood, and so to the Pith itself : These Vessels are generally filled with Sap.

Beside the Fibres that ascend from the Root, and constitute the Wood and Bark, there are other Vessels disposed in the same Manner, and ranged along the Fibres at proper Intervals of Distance, through the whole Substance of the Wood ; these form the Air Vents, and the Vessel properly so called.

The Air Vents. The Air Vents are a Set of Tubes, composed of Fibres revolving in a spiral Line, and in one Part extended in little Ramifications to the external Air, and in the other continued and enlarged to the very Root : These Vessels are always empty.

The proper Vessels. The proper Vessel is a large Duct filled with Oil, extended in Length between the Fibres of the Wood, and rising in different Ramifications like the Air Vents to the Top of the Plant, and the external Air : I call this the *Proper Vessel*, because it contains an Oil which varies according to the Nature of the Plants, each Species being impregnated with a viscous Fluid, proper, and indeed peculiar to it. In some Plants this Vessel contains a kind of Turpentine ; in others

'tis

'tis a Sort of Rosin or Pitch ; here it proves a Gum, and there it is a Species of Milk : 'Tis elfewhere a real Oil, and sometimes it assumes the Qualities of a Honey, a Syrup, or a Manna.

We must now bestow a few Words on the Origin of Knots, and the Nature of the Buds The Knots. that are always lodged in them. Towards the Top of the Plant, and in some other Parts of the Trunk and Root, Rows of little Branches shoot from the Body of the Wood, united and interlaced with each other ; these traverse the Wood, the sappy Substance and the Bark, and their Extremities are projected to the external Air : These Rows are composed of hollow Fibres, proper Vessels, and especially Air Vents or empty Spiracles. The Union of so many different Vessels swells and enlarges, in some Measure, that Portion of the Bark in which they terminate ; and this is what we call the Knots, the whole System of which is calculated for the Service and Growth of the Buds. These are so many little intire Plants, all furnished with their Vessels and other Parts, rolled over one another like Threads wound into a Ball : The Outside is defended by several Foldings, and they are lodged in the Knots of the Tree, that they may extract from them in their Turn all the Nourishment necessary to their Expansion : I say in their Turn, because these Buds are subject to the same Process that appears in the Eggs or Seed of the young Offspring of Animals ; there are Degrees and Diminutions of Growth that reach, as one may say, to Infinity itself. The Wisdom and Goodness of the Creator is as conspicuous in this Oeconomy as his Power itself ; since it not only supplies us with excellent Fruit this Year, but reserves a Liberality of the same Presents for the next ; and by preventing all the Buds from opening at the same Time, by unequal Preparations, he treasures up for our Tables and Fires a Stock of Supplies that are really inexhaustible.

Our Observations have hitherto been confined to the Trunk or Body of the Tree ; we The Root. will now proceed to the Head and the Root. This latter appears to be only a Continuation of the same Parts we have already considered in the Trunk : The Fibres that shoot from it on The Fibres. every Side are probably an Extension of all

the

the lesser Vessels that terminate in the external Bark, and there form Knots to recruit the Tree, both in the Earth and without. In the latter Situation, when the Tree is stripped of its Branches; in the former, when some Accident has deprived it of its Root: All these little Vessels inclose others of the same Structure, and whose Minuteness is inconceivable; all of them likewise having other Knots and other Buds, and Means, without End, to preserve the Tree, and perpetuate the Species.

We discover the Proof of this amazing
Slips and Layers. Arrangement in Slips, and Layers. A Slip of the Willow or Gooseberry-tree, or, in other Words, a simple Stick of each Species, immediately takes Root when stuck in the Ground.

The Branch of a Vine, laid and bent into the Earth, shoots out Fibres through the Knots that are buried; Cut the Branch off, where it joins with the Stock, and the other End that rises out of the Ground becomes a new Vine.

The Strawberry Plant spontaneously
Shoots. throws out, on all Sides, Trains or long Fibres, which have Knots. These latter extend their Filaments in the Earth, and become so many new Stems. The Water and Salt, the Oil, Air, and Fire, which contribute to their Growth, are not furnished with any Intelligence, to enable them to design or form, to place or play off the Instruments necessary to the Life of the new Plant: All these additional Roots, that spring from Knots, frequently imperceptible in the Slips and Layers, were lodged there in Miniature, and are only a System of Branches, which constituted the Knots of the Stock, and which are then lengthened and disengaged from their former Constraint, and conducted under the Earth, according as the Sap flows into their Apertures.

As to the Knots and Bud, which form
The Head of the the Head of the Plant by furnishing it
Tree. with Branches, Leaves, Flowers, Fruits, and Seed, a particular Account of their various Manners of expanding themselves would be endless: Let us content ourselves therefore with observing, that the Branches and Pedicles of both Leaves and Flowers are so many Extensions and new Distributions of all the Vessels we have seen in the Stock; that these Vessels afterwards expatiate, more at large

large thro' the whole Extent of the Leaves; that the Fibres of Wood are distributed in long Ranks, which we call the Ribs; that these Fibres sustain the Air Vents and the Vessel of Oil; that the Orifices of the Vents and proper Vessels are on the upper Part of the Leaf, and open to the Sky; in a Word, that cross the Fibres, and in the whole Substance of the Leaves and Flowers, a vast Number of little Vessels are placed in horizontal Lines, the Plenitude and Variety of whose Juices fortify the Leaf and Flower, and paint them with their different Glow of Colours.

These, my dear *Chevalier*, are the Particulars we have frequently discovered, with our Microscopes, in the Generality of Plants; and indeed, they are no more than a short Sketch and imperfect Outline. We must now animate the whole System and shew you the Progress of the Sap, and the proper Juices. But if all these minute Parts are difficult to be distinguished, the Use of each Vessel, and the Course of their Fluids are attended with much more Intricacy. I have frequently attempted to discover the Cause of the Sap's Motion: I think I have observed its Circulation, and had some imperfect View of the manner in which it is performed, but I durst not attempt any thing on that Article.

Chevalier. Perhaps the *Prior* may not be so timorous.

Prior. I will venture at one Conjecture, and let it be regarded by the Company, no otherwise than as it may appear natural and agreeable to Experience. It seems to me, that the Impulse of the Air is capable of circulating the Sap, thro' the Vessels whose Structure has been described to us, and is sufficient to produce the several Kinds of Progress, and all the Variety of Accidents visible in Trees.

If Plants are furnished with these Vents or Wind-pipes, the Intention certainly must be to promote a Transpiration of Air; and if they breathe this Element like Animals, it must produce in them some of the Effects it accomplishes in these. The Motion of the Blood and other Fluids, in living Creatures, seems to be effected by the Air, because, when the Communication of this is intercepted, their Blood immediately grows thick and coagulates, and they die the Moment they are deprived of its beneficial Effects. This Element therefore is in all Probability the Principle of the Motion and Progress of Sap in Plants; and two Circumstances concur to produce this Operation; one is the Elastic Power of the Air, or that Spring with which it expands

pands itself, in Proportion to the Heat that penetrates its Parts, and the Dimensions of the Place where it obtains more Freedom; the other is the Structure of these very Air-pipes, whose spiral Rings, as they are capable of Extension, Tumefaction and Enlargement, naturally put all that surrounds them in Motion.

The *Chevalier* must not be startled at the word Elasticity or Spring: It is known by Experience, that the Air shrinks and is compressed by the Cold, and is dilated and expanded into larger Dimensions by Heat. The various Changes of the Seasons make us sufficiently sensible of these Effects, of which we may have a tolerable Idea, by comparing the Body of Air that surrounds us, to several Locks of Wool thrown together in a Heap: Press this Wool, and you will find it immediately shrink and contract itself under your Hand; but when it is left to itself, it swells and takes up more room: It is the same with respect to the Air. The only Difference that can be thought of is this; the Fibres of Wool have but little Force, whereas the Particles of Air are actuated by such a powerful Spring, that the Moment they are released from their Confinement they expand themselves with surprising Violence, and frequently smother whatever opposes itself in their Way. Let us apply this Spring to Plants.

The Gardener opens and turns the Earth with his Spade or Plough; in this Earth a Multitude of airy Particles are lodged, and when, at the Return of Spring, and the first Heats, the Atmosphere or Body of Air, which gravitated upon us by the Pressure of the Cold, begins to rarefy and expand, and becomes subtilized by the Rays of the Sun, these returning Heats likewise communicate their Impressions to the Air in the Bowels of the Earth, upon which it begins to dilate in some degree, and endeavours to break from its Confinement; it acts upon, and strongly presses the Matter that surrounds it, and forces into Motion all the Water, Salts, and Oil it meets with under the Earth: These Elements, being thus worked into Activity, insinuate themselves into the little Orifices of the Seed, and flow through all the Pores of their Covering; the small Vessels that fill the Seed, being so many empty Bags, whose Mouths are always unclosed, are easily replenished in their Turn; and as they are open at each Extremity, the Sap passes from the first Tube to the second, and so to the Rest
in

in Succession; by which means it moistens them all, and, in less than the Space of twenty four Hours, arrives at the Pedicle or Root of the Bud, after a Passage through the hollow Branches, which are dispersed from all Parts of the Lobes, and re-united in two different Parts of the Root: This Root, together with the Stem of the Plant in the Bud, and the seminal Leaves which cover that Stem, are likewise fill'd with hollow Vessels, that drink in their Turn, and quickly improve their Growth, with what they receive from the Lobes. All these little Vessels, being swelled in this Manner, gradually rise and enlarge the Fibres they traverse; these too have their Nourishment, and consequently lengthen and swell. The Root continues to shoot out, and, in a few Days, arrives at the little Passage that opens in the Skins that enfold the Seed, and then receives the nutritive Juices of the Earth, which flow into the Extremities of its Fibres. The Stem and Seminal Leaves, being enlarged and animated by the same Process, and daily pushed forward by new Juices, mount to the Surface of the Earth.——

Countess. With your Permission, I must interrupt you here. When a Husbandman sows, he scatters his Corn at random, and a Gardener, in planting Peas or Beans, neither observes the top or bottom of the Seed. If this Seed is inverted, so that the Stem be at the Bottom, and the Root uppermost, by what means can this little Stem rise into the Air? And who gives the Root to understand, that its Office is not to ascend, but to sink and continue in the Earth?

The Direction
of the Stem and
Root.

Prior. This however is the Conduct they always observe, and the Root itself, after it has sprung upward a little when the Seed has been inverted, falls into a contrary Deflexion, and bends and sinks downwards into the Ground. † The Stem, having penetrated to a small Depth, always takes a different Turn, and at last rises to the Surface of the Earth, and generally continues its Ascent in a straight Line, without bending either to one Side or the other, unless it be one of those Plants whose Fibres are contorted and weak, of which Nature are those that form the Vine, the Ivy, the Hop, and several others; in which Case, Nature has provided them with Tendrils, twisting Sprigs, and other Con-

† Memoir. de l'Acad. 1700, 1701. Nieuwentyt, Grew.

veniencies for fastening on what comes in their Way, and supporting themselves on a Prop: But, in general, the Root of a Plant shoots into the Earth, and the Stem rises, and ascends perpendicularly into the Air. This is certainly as it should be: but the Difficulty is to account for their Efforts to disengage themselves from any Obstacle to their appointed Progress. We do not imagine them capable either of Understanding or Choice. All these Tendencies, from which there are no Deviations, are, in my Opinion, naturally accomplished by an Impulse of the Air. The Particles of this Element, which the first Heats begin to unfetter and disengage, meeting, at the Bottom of cultivated Land, with all the Resistance of an hard and untractable Mass, turn their Activity on the soft Earth, and there cause all the Juices to rise. The Sap, chased from its former Situation, escapes through all the Passages that are open to it, and either ascending or flowing obliquely, through the Root and its capillary Branches, all these supple and pliant Fibres must unavoidably comply with this Impulse, and gradually sink into the Earth, whatever Track might be first taken by the Root. The Sap being put into Motion in the Stem, and pushed on by that which succeeds, mounts upwards, and naturally draws to the same Quarter the Seminal Leaves; which, in forcing their Way upwards, through a few Inches of light and porous Earth, find not so much Obstruction as they would meet with from the Earth below, and on each Side; and so true it is, that the Ascent of the Sap forces the Root into a contrary Direction, that we have frequently seen Acorns, and other Seeds, even out of the Earth, shoot forth in moist Places, and for some time raise their Root upwards; after which they have by Degrees deflected it towards the Earth, from which it was then at a considerable Distance. The Root ascended at first, because, as the Seed was inverted, the Juices of the Lobes necessarily forced the Root upwards; but when it began to receive its nutrimental Juices immediately from the Vapour which ascended from the Earth, this Vapour, in consequence of its Tendency aloft, flowed into the Tube of the Root, and attracted it downward, to itself, by the Continuation of its Action. I one Day accidentally left a few Grains of Corn upon my Standish; the Humidity of a Sponge, which was there wrapt round a little Vessel of Water, made the Corn which was under it shoot out; the Root, when it had sprout-

It sprouted forth a little, did not descend from the Side of the Standish, in order to continue its Progress to the Earth, but ascended, between the Sponge and the Vessel, towards the Aperture from whence the Water flowed into the Sponge, and at last reached the Fluid itself. Do you imagine this Root had any particular Inclination to that Part? No certainly; but the Vapour or Humidity which exhaled from the Sponge, and especially from the Aperture of the Vessel, in its Descent, flowing into the Root, raised it in a Direction contrary to the Descent of the Vapour, and attracted it to itself. If then the Root of a Plant shoots down into the Earth, it is owing to the Impulse of the Sap, which produces this Effect.

Countess. This Explication is natural enough: but as yet I don't comprehend how you can ascribe to the Impulse of the Air, the upward Growth of the Stem, or that Disposition in most Plants to raise and sustain themselves aloft, with that noble and majestic Air which adorns all Nature.

Prior. When the two Seminal Leaves are once shot into the open Air, the whole Affair is accomplished; if you strip them from the Stem, the Plant will soon die; but if you permit them to grow, it will quickly rise and ascend in a straight Line. It rises soon, because the external Air being introduced with the Fluidity of frequent Waterings, or with the Moisture of the Night, through the Orifices of the little Air-pipes, that open on the Surface of the Seminal Leaves, dilates itself in the Plant, when warmed by the returning Sunshine; it extends the Spiral Rings of the Air-Tubes, and presses all about it. Those Particles of this Air which escape into the Lobes, complete the Pressure of their Utricles, and drain them with their Juices to enrich the Stem. The other Particles that flow into the Root, cause the Sap to ascend into the Body of the Plant, and are daily pouring it into new Vessels: These Vessels swell and sustain the Fibres, and, at the same Time, force them to ascend. The Bark enlarges, the Leaves open, and Vigour reigns through the whole. With this Assistance of Air, the Stem not only rises soon, but likewise ascends in a straight Line, because the Impulse of the Air, which flows into the Vents presented to it by the little Stem, has a Tendency upwards; and as the external Air likewise encompasses all the Plant, and, in its Descent, equally insinuates itself into all its Parts, equally dilates all its Air-Vessels, and equally fortifies all its Fibres;

bres; no Reason can be assigned, why such a Plant should incline to one Side more than another, unless some foreign Accident intervene to bend it. The Lobes and Seminal Leaves begin now to be useless to the Plant; since its own Foliage provides more availing Supplies, by the Multitude of new Air Vents it unfolds, and through which the external Air, forcing into Motion that which it finds within, raises from the Roots a Quantity of new Juices that fill the Fibres, the Utricles and Pith, causing a vigorous Youth to succeed a delicate and feeble Infancy. The Juices which then ascend in the Plant are too strong to be admitted into the tender Fibres of the Seminal Leaves; they find freer Passages elsewhere, into which they flow. The small Quantity of Sap remaining in the Utricles of these Seminal Leaves completes its Discharge into the Stem, or else evaporates without being recruited; by which means both the Seed and Seminal Leaves are exhausted, and gradually wither, or rot away.

As the Plant is now no longer in its Infancy, let us examine in what Manner it receives its Nourishment.

Count. I am no longer in Pain, to discover the Principle of Motion in the nutrimental Juices, since the Air we breathe, by the Mediation of a single Windpipe, and which is capable of imparting Motion to the Aliment, and Fluidity to the Blood, enters through a Number of Canals, into the Bodies of Trees, and the very Depth of the Earth, where it descends, in order to find out and convey proper Nourishment to Plants; and it is easy to comprehend, how the Air, acted upon by the Sun's Heat, and expanding by its natural Spring, can push before it, and impel into the Apertures of the Roots, what Juices it meets with; but my great Difficulty is to know, how the Air and Heat are capable of conveying to each Plant the very Juices that peculiarly correspond with its Nature.

Countess. This is what I was waiting to hear the Prior clear up. These Plants are fixed in the Earth by as many Fastenings as they have Roots, and cannot move one Step to provide for their Necessities. How can the heated Air then furnish them precisely with what they want? For each Species has its particular Inclination and Taste. This must be supplied with acid, and that with softer Salts; one demands Milk, another must be nourished with Oil: How then can they be all accommodated, without any Mistake?

Prior,

Prior. Should the Air indeed change its Operations, and convey a Flow of acid Juices to a Tree that requires Oil, a single Kitchen Garden would disgust a number of People. But the Air and Heat have it only in Commission to give Motion to all the Juices they find, and direct them to the Plants, who are then to chuse for themselves whatever they want.

Chevalier. How, Sir! have Plants then Discernment enough to single out what is proper for them, and reject all that may prove injurious?

Prior. Discernment, Sir! You would not imagine to what a Degree of Nicety their Choice extends. But, to make you sensible of it, let us compare the Earth of a Kitchen-garden, impregnated with its different Juices, to a Vessel in which Oil, Water, and Wine have been promiscuously poured. Take three Linen Fillets, and steep the End of one in Water, the End of the second in a few Drops of Oil, and that of the third in Wine; after which, dip these three Fillets into the Vessel, in such a Manner, that their moistened Extremities may plunge into the Liquor, and the Ends that are dry may be raised and brought over the Rim of the Vessel, a little below the Surface of the Liquor; the Fillet, which was first steep'd in Water, will fill itself with that Fluid, and distil no other; that whose End was immersed in Oil will evacuate Oil alone; and the other will redden by Degrees, and no Fluid but Wine will drip from it: They never vary in this Operation, and you will find something in Plants that perfectly corresponds with this Proceeding. That Being who created them, and by whom they are supplied with all the Vessels necessary to their Nourishment and Propagation, has not neglected to place, at the lower Extremity of these Vessels, a System of Strainers, whose different Apertures easily admit certain Juices, and reject all others. The proper Vessel seems, more especially, to have been impregnated, towards its Extremity, with some Drops of the Liquor, which imparts a distinct Scent and Flavour to the Fruits of every Plant; by which Means, the Fibres permit only Water and certain Salts to flow into their Orifices, and the proper Vessel gives Admission to nothing but Oils, perfectly conformable to the Nature of its own, whilst all others will be

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constantly

The Refinement of the Sap in Graft.

constantly excluded. By the very same Process, the Sap of a wild Stock is refined, by its flowing into a good Branch grafted on it. This Sap meets with Strainers, or the Orifices of Tubes, too fine to give Admission to its grosser Particles, and consequently none but the most delicate can pass through: At the Entrance into the proper Vessel, it arrives at a System of Glands, impregnated with a certain Oil: All the Particles of the Sap, that correspond in Fineness with this Oil, are well received; the rest flow in a different Track, and are distributed into Branches where they may prove more acceptable. And thus the same Tree is capable of producing Fruits, very different in their Natures and Qualities.

Chevalier. I am lost in Astonishment, at the View of so much Simplicity and Prolificness, in the Works of the Deity.

Prior. We may conceive, at least in some Degree, how Plants of a different Nature, may, in the same Earth, and without any Effort or Motion of their own, be supplied with Juices and Liquors necessary to their Welfare; and now, if possible, let us attempt to pursue these Fluids, in their Progress, and discover whether the Ascent of the Sap, from the Root to the Branches, and its Return from the Branches to the Root, be a Fact or not, and in what Channel it flows.

I am much inclined to believe, that the Sap neither ascends thro' the Pith nor the Bark: It cannot rise through the Pith, because this is unprovided with Vessels proper to convey it upwards, and is only furnished with little Cavities to contain it. In short, it is the common Reservoir of the Sap, but not the Canal through which it flows. There is likewise as little Probability, that it should mount through the Fibres of the Bark, because the Sap which is found in the Bark of several Plants, as Cherry Trees for Instance, is tinged with a very beautiful Red, a Quality not imparted to it by the Earth; and which, indeed, it cannot acquire any otherwise, than by the Intermixture of

The Use of the Fibres of the Wood.

the Juices that descend from the Leaves and Fruits. It remains for us then to say, it ascends thro' the Fibres of the Wood itself, in

in the Extremities of its whole Circumference ; and indeed these long Fibres, so proper for the Conveyance of Fluids, are the very Vessels wherein we find the crude Sap without Colour or any other Quality, unless it be generally a very sharp Acid. It refines in its Progress through the Tubes, which, in their Ascent, contract themselves into lesser Dimensions, and allow a Passage only to light Juices and Salts. The Sap flows into the Leaves, where it acquires its Perfection, because a great Number of Air-vents, opening to the Sky on the upper Surface of the Leaf, are perpetually supplied with humid and refreshing Streams, together with new Accessions of Air, and new Particles of Nitre, Fire and salutary Spirits, which mingle with the Sap, and, after Subtilizing all its Parts, qualify it for Admission into Flowers and Fruits.

The Use of the Leaves.

It is likewise very credible, that the proper Vessel, as it shoots its Branches into all the Leaves, Flowers and Fruits, diffuses into them a certain Honey or Oil, that mingles its balsamic Particles with the Air, Salt and Water, from whence the Scent and Flavour of Fruits and Flowers evidently result. This Observation agrees very well

The first Use of the proper Vessel.

The Origin of the Scent and Flavour of Fruits and Flowers.

with Experience : No Parts of the Tree are more oily and shining than the Leaves and Flowers ; and the Conformity of Taste between the Oil which moistens the Leaves, and the Fruit cover'd by their Expansion, is very sensibly perceived in several Trees, particularly those that bear the Walnut and the Peach. The Leaves have before-hand that agreeable Bitterness and Taste, which they afterward communicate to the Fruit and Kernel they are to produce. The Sap, purified and perfumed in the Leaves, acquires a Delicacy sufficient for its Admission into the Pedicles, or Stems of the nearest Flowers or Fruits ; and this is the Track wherein, according to all Appearance, it flows ; because when Caterpillars, or other Accidents, have stripped the Trees of their Leaves in the Spring, the Fruits which began to be formed, wither away ; certainly not for Want of Sap, the Mildness of that Season furnishing them with a sufficient Quantity, but only for want of Sap

prepared and accommodated to the Vessels that compose these Fruits.

The Return
of the Sap.

The Sap, whose Grossness made it incapable of a Reception in the Capillary Vessels of Leaves and Fruits, apparently discharges itself into the Bark.

That Sap, the Fineness of whose Juices gave it Admission into the Leaves and Fruits, after it has passed through the Fibres, the Utricles and the Pith, divides itself into two Branches, one of which flows back thro' the Bark, and the other evaporates, by Transpiration, through the Epidermis, or external Bark.

The refined Sap, which flows back through the Bark, colours the grosser Sap, which likewise repasses there and the Mixture of these two Fluids produces that admirable Effect in the Bark, which his Lordship made us acquainted with before; I mean the detaching and Nourishment of the last Round of Fibres in this Bark, in order to incorporate it into the Wood, and enlarge it with a new Circumference. But this is not the only Function of the Sap which descends into the Bark: Its finest Particles are received into the Utricles, and those which are too gross, are precipitated towards the Root, in order to be raised and filtered a-new.

The Juices which are received into the Utricles, flow, through the Fibres of the Wood, to the Pith, where they perform two Functions: First, they refresh and nourish the Wood through its whole Length; and then pass from the Utricles, into the Transverse Fibres that form the Knots; by which means, the Gems lodged there are impregnated with a Juice perfectly prepared and adapted to their delicate Structure; and if you top a Tree, the Utricles, as they then receive a greater Quantity of Sap, shoot out more Gems. This Progress which I ascribe to the Sap, from the Bark to the Utricles and Pith, and from thence to the Fibres of the Knots, is exactly conformable to the Disposition of the Vessels; and the more probable, because Plants which have many Gems, Flowers and Fruits, are likewise furnished with a large Quantity of Pith, as the Elder for Instance; and, on the contrary, those that have but few or no Gems to nourish, are quite destitute of Pith; of this Sort are the Stalks of Beans and Corp.

As

As to the other Part of the refined Sap, which evaporates through the Epidermis, or fine Skin of the Leaves and Fruits, it only transpires in Proportion to the Openings of the Pores. A gentle Heat, qualified with soft and refreshing Gales, keeps all the Juices of Plants in Action, and prevents an immoderate Evaporation: 'Tis this which preserves the great Quantity of Sap they possess, both in Spring and the Close of Summer.

The two Saps.

But the Heat is sometimes so violent, and opens the Surface of the Leaves, and other Parts of the Plant, to such a degree, that the Juice of the Utricles, which run horizontally to the Epidermis, soon flows out and dissipates. The Utricles then lose more Sap than is restored to them, and consequently must shrink and flatten, like empty Bags; the Fibres, which they sustain, languish and fade for Want of that Support, and you then see the Leaves and little Branches hang down as ready to wither. Whilst the excessive Heats continue, the Tree thrives more by Night than in the Day, because the Night recruits it with more Juices than the Day had evaporated.

But, beside the Freshness and Humidity of the Night, Nature has prepared for this Evil another Remedy, which is always practicable, even in the ordinary Heats.

The second Use of the proper Vessel.

The proper Vessel, which contains a gummy Fluid peculiar to every Plant, is not only designed to complete the Sap and Flavour of Fruits, to perfume the Air with the most fragrant Odours, to paint the Flowers and Fruits with the amiable Glow we so much admire, to furnish the Bees with the Syrup they extract, and to accommodate Mankind with salutary Oils of every Sort; besides all these Effects, it has another Function; for it diffuses over the Leaves a small Quantity of its Oil, the light Flow of which, tho' it cannot prevent the violent Infusion of Air into the Vent-Holes, is sufficient to cover and close up the other little Orifices of the Epidermis and Sap-Vessels; and this preserves the Juices from too great a Dissipation.

Ever-greens.

From hence it apparently follows, that Plants abounding with this Oil, which in them is more viscous and difficult to be evaporated, must be always green, such as

Box, Laurel, Orange-trees, and especially Pines, Firs, and Yews, which spread their Verdure in Regions exposed to the severest Colds, and most neglected by the Sun. These Trees are slow in their Growth, because they admit less Air than others, but they retain better what they have received, because the Oil of Rosin, with which they are impregnated, defends their outward Surface, and prevents Heats, Rains, and sultry Winds from dissipating their Juices, and impairing their Growth.

The Fall of the Leaves.

When the first returning Colds begin to contract the outward Surface of the Leaves, the Sap is then evaporated in a much lesser Quantity than it was before, and as the Juices which still continue to ascend, thicken the Leaves; these are then carried away by Winds, and their own Weight, or at least their Oils and other Fluids are gradually dissipated, without being recruited; in Consequence of which, the Foliage assumes a yellowish Hue, and is only a Complication of withered Vessels, and dried Fibres. Winter at last benumbs all Nature, and her vegetable Works appear indolent and disarrayed, till the returning Sun enlivens them anew, by reanimating the Air and Sap.

Count. There are two Points in your Supposition, which may be separately considered: One is the Manner in which you represent the Circulation of the Sap; the other, the Cause to which you ascribe it.

As to the first Particular, I am very inclinable to believe, that the Juices of the Earth, and those of the Air, or the aerial Spirits, have an alternate Motion in Plants; and that the former ascend, by Day, thro' the Wood and Bark, and the latter descend with the Sap, especially in the Night, through the same Canals. But I confess there are several Experiments which seem to favour your Opinion.

If a circular Gash be opened in the Bark of an Olive Tree, it will produce, that Year, a double Quantity of Blossoms and Fruits; but all the Growth about the Wound will afterwards languish by Degrees, till it be quite dead. The Cause of both seems to be this: The Sap, being intercepted, in its returning Flow through the Tumour which is formed in the Wound, is, at first, plentifully diffused through the Branches, after which it thickens, and then

then continues in a constant State of Stagnation.

I know some Plants, very tender and full of Milk, which afford Circumstances that corroborate your Opinion: When you bind them very tight about the Middle of the Stem, you see by Degrees, all above the Ligament swell, and appear ready to burst, which can only proceed from the milky Juice which rises from the Root, through the Body of the Stem, towards the Top, and afterward descends along the Bark, and would continue its Progress to the Root, were it not stopp'd by the Binding, in the same manner as the Blood flows from the interior Vessels or Arteries, through secret Ducts, into the exterior Vessels called the Veins, and, from thence returns to the Heart, unless you obstruct its Course by a Ligament; after which it increases in Quantity, and visibly swells the Vessels above the Binding.

The Milk-
Thistle.

'Tis well known, that the *Indians* by making an Incision at the Bottom of the Bark of their Palm or Date Trees, and inserting a slender Reed, extract a very agreeable Liquor in great Plenty, which they call Palm-Wine; and which, in a few Days, changes to Vinegar. In my Judgment, we need only suppose the Return of the Sap through the Bark, to account for this Fact. How could the Sap, in rising from the Earth through the Bark, as is commonly imagined, acquire that aromatic or vinous Flavour? It is much more natural to say, that this Sap, ascends through the Fibres of the Wood; filters and refines itself, to its Perfection, in the Leaves, and there mingles with the Liquor of the Vessel proper and peculiar to the Palm-Tree; after which, that Part of the Juice which flows back from the Leaves, mixing itself in the Bark with the Fluid that ascends from the Branches, produces a copious and agreeable Liquor. At the Expiration of a few Days, the volatile and pleasant Juices which, in that Liquor, corrected the Acrimony of the Salts, and the bitter Flavour of the crude Sap, being evaporated, the *Indians* have then nothing but a gross Sap, in which the Salts are unsheathed, and this makes their Vinegar.

Palm Wine.

As to the Cause of the Circulation, which you ascribe to the Action of Heat, and the Spring of the Air, the Proofs

are very numerous. Plants are so subject to the Impulse of the Air, that they faithfully submit to all its Variations: They die when they are destitute of its Supplies, they languish when they have but little; they are benumb'd when it is condensed, and re-animated when it recovers its Vigour.

I lately made an Experiment, which is so favourable to your Opinion, that it would be Injustice to conceal it from you *. I sow'd some Lettice Seed, in Earth exposed to the Air; and at the same time sow'd a few more of that Seed in Earth, which I placed in the Receiver of an Air-pump, and immediately drew out all the Air. The first Parcel of Seed sprouted forth, and, in the Space of eight Days, shot up an Inch and a-half high; but that in the Receiver did not spring up in the least: I then let the Air in, and immediately every thing was in Motion, and, in less than eight Days, the Seed shot up to the Height of two Inches and more.

It is likewise owing to the Power of the Air, that the sprouted Barley, which is brewed for my Servants, and usually kept in a Cellar, turns and directs all its Shoots to the opening through which the Air flows. The Air, which enters at that Passage, streams into the Pores of all the Grain, and turns them to that Quarter, which is a Confirmation of your Remarks on the Tendency of Plants.

The same Tendency is observable in all Plants laid in Cellars; for their Leaves are always directed to the Air Vent or the Door.

In a Word, so true it is, that Plants are only strong or weak, in proportion to the Force or Imbecillity of the Air, which insinuates itself into their Pores; that if you expose Succory, Cardoons, and Selery, in the open Air, they will be tinged with a very strong Green, but the Flavour of their Juices will be too bitter; whereas if you bind them with a String, or lay them up in Bundles, as the Air then enters their Spiracles with Difficulty, it only operates upon such weak Juices as correspond with the

Philosoph. Transactions, n. 13. Lowtherp's Abridgment, Vol. II. p. 845.

Smalness





A. Motte sculp.

The different parts of
Flowers

Smallness of the Fibres ; in consequence of which, all those sprouting Leaves you discover in the Inside of these Bundles, advance but slowly, and, as they are incapable of enlarging their Fibres, they always preserve an Air of Delicacy and Youth ; every Part is tender, the Flavour agreeable, and the Colour extremely pale.

Chevalier. I have sometimes asked our Gardener the Reason of this Fact ; but he only answered, that it was his Business to tie the Succory into Bundles, and mine to find out the Cause of their whitish Complexion.

Count. If the Air fortifies and unfolds Plants, in proportion as they are susceptible of its Power, we have then the Solution of a Question, which has frequently employed our Thoughts, though we could not come to any particular Determination. Look on that little Hill,

Chevalier, it ends in a very level Plain, on which you observe a large Walnut-Tree, and another on the Slope of the Hill : Be pleased to take Notice, that the lowest Branches of the Tree, which grows on the Plain, are exactly parallel to the Earth, over which they spread, and every where at an equal Distance from it. Observe likewise, that the lowest Branches of the other Tree, on the Slant of the Hill, are equally distant from the Declivity ; but the Tree, to acquire that Arrangement, has shot out a much greater Number of Branches towards the Bottom of the Hill than at the Top. You will constantly observe that the lowest Spread of Branches, of those Trees which are permitted to have their natural Growth, will correspond with the Position of the Earth they cover, and describe an oblique or horizontal Line, to preserve, in every Part, an Equidistance from the Earth. If the Reason of this kind of Tendency be demanded, I think, it is to be discovered in the *Prior's* Conjecture, and flows from it as a natural Consequence.

Why the lower Branches of Trees are parallel to the Earth on which they are planted.

The Trunk of the Walnut-Tree, on the Declivity of the Hill, forms an acute Angle with that Hill, towards the Top, and the same Trunk makes an obtuse Angle with the Hill, toward the Bottom ; or, in other Words, there is much less Space between the Tree and the Earth of the upper Part of the Hill, than between the same Tree

and the Hill, toward the Bottom. If therefore there be six Columns of Air between the Tree and the Earth, toward the Summit, or in the acute Angle, there will be nine or ten Columns, toward the Bottom, or in the obtuse Angle: Now, where an equal Quantity of free and active Air is diffused, there very near an equal Growth of Branches will spread; and, on the contrary, where the Air has a stronger Impulse, there a greater Number of Buds and Branches will spring forth. With respect to the Tree that grows on the level Plain, you see an equal Distance between each Side of the Top of the Trunk and the Earth; these are two right Angles: On both Sides there is an equal Impression of Air, and consequently you observe, both on the one and the other, almost an equal Quantity of Branches; and as those on the right Side fill a Space equal to that on the left, the whole Base is therefore very near parallel to the Horizon, and almost equidistant from the Earth, in every Part. For the same Reason, if the Walnut-Tree on the Slope of the Hill, shoots forth six hundred Buds, on the upper Side, by Virtue of the Impulse of six Columns of Air, it must necessarily unfold a thousand Buds, on the lower Side by the Impression of ten Columns: And this side undoubtedly producing more Buds, the Branches, which are their Offspring, will possess more Space than those above, and therefore, shooting into a proportionable Extent, they will approach as near to the Earth as those on the upper Side; and, consequently, 'tis altogether as natural for the Base of those Branches that grow on a Slope, to correspond with its Obliquity, as it is for the Base of such Branches as grow on a Level, to be as even and horizontal as the Soil over which they are diffused.

Prior. The more simple the Consequences are, and the more natural the Applications that result from our Conjecture, the easier it will be received. You see, *Chevalier*, two dead Trees at the Entrance into the Orchard: Perhaps what we have advanced, will enable us to guess at the Cause of their Distemper and Death. One is intirely covered with Moss, which is a Plant that grows on Trees, and shoots out a prodigious Number of little Roots and Branches: The other Tree was killed by being buried under

The Effects of
Moss and Gum.

der the Ruins of a Wall which was afterwards rebuilt. But wherein can Moss and Earth be injurious to Plants?

Chevalier. 'Tis evident that the little Roots and Branches of Moss, by almost covering the Tree from Top to Bottom, have closed all the Air-Vessels and consequently rendered the Tree incapable of Respiration; and when the Air ceases to operate upon it, no more Sap can be expected.

Countess. 'Tis altogether as plain too, that if the superfluous Juices transpire through the Bark, this Tree which has been thus buried, must be killed by the Stagnation of the Sap. Moss likewise will occasion the same injurious Effect.

Prior. If the little we know, of the Use and Correspondence of the inward Parts of Plants, be sufficient to fill us with Admiration, what will our Astonishment be, when we come to consider their Fecundity! Their Roots, their Stem, all the smallest Branches, the Generality of their Flowers, their whole System of Seeds, are impregnated with Buds without Number. A single Tree, a single Branch, nay, a single Seed, is sufficient to communicate a Species to the whole Earth, through the Succession of all Ages. This Fertility has the Air of a perfect Prodigy, and, if we ought to be affected at the Excellence of the Gifts we receive from the Deity, I think the Profusion with which he bestows them, should give us the same Impressions. He has not only been pleased to grant us the Possession of this or that beneficial Plant, but has likewise will'd and preordain'd, that Mankind shall never be destitute of them, whatever Accident may happen.

Countess. Not long ago, we had the Company of a Gentleman of excellent Understanding, who attempted to count the Seeds in one of the Branches of a young Elm, which had been planted twelve Years; and forming a Judgment of eight other principal Branches, by what he discovered in this; and computing the Produce of an hundred Years, by that of one, his Calculation amounted to Millions and Myriads of Millions of Seeds*. He likewise counted all the Buds that were visible, and in a Condition to produce new Branches in one Year; and then adding

* Memoirs de l'Acad. des Scienc. M. Dodart. 1700. and Nieuwentyt Hist.

them to those that would be the Product of a Century, and at the same Time, including such as at present remained, useless in every Part of the Tree, for want of the necessary Preparations for their sprouting forth, he made a Computation perfectly stupendous, and very judiciously concluded that not only the Marks of Wisdom and Power, but, if we may presume on the Expression, the Traces of Infinity itself were impressed on all the Works of the Deity.

Prior. These Truths are worthy our highest Admiration and Reverence. They astonish us, because our Faculties are limited; but it is good to have an imperfect View of them, that we may be sensible of our own Insufficiency; and where do we not meet with Opportunities for such a Conviction? 'Tis not only the immense Number of Seeds in a Plant that confounds our Imagination; a single Flower, even in its visible Exterior, and which we behold opening in a Morning, and fading at Night, presents us with the Traces of a Wisdom, to which neither our Eyes nor Reason are capable of attaining. It was the Deity's express Intention to overwhelm us with this Species of Infinity, that unfolds itself in all his Works, and even in the minutest Creatures, to keep our Understandings in Subjection to that Infinity which shines in his Essence, his Attributes, his Providence, his Operations and Mysteries.

Countess. It is very certain that a Flower, which seems such a common Object, comprehends not only Beauties, but even Advantages and admirable Designs. I always considered a Flower as a Work in Miniature, created to entertain the Eye with amiable Colours, and sometimes to refresh the Smell with fragrant Exhalations, and that was the utmost of my Conception: But my Calculator surprized me exceedingly, when he acquainted me, that the Flower was not only the Sheath and Covering of the Fruit, but that even every Part of that Flower was necessary, in order to give the Fruit its Formation and Shape; and I shall never forget his * ingenious Explanation of all these Particulars. We Women, who have seldom the Advantages of any great Instruction, are sometimes much more astonished than your Sex at a new Discovery, and

* Samuel Morland transact. phil. n. 287. Ray's Hist. of Plants. Memoir. de l'Acad. des Sc. M. Geoffroi, le Jeune, 1711.

easily retain it, because we are not subject to the Confusion a Number of Sciences might occasion.

There are some Flowers, said the Gentleman of whom I am speaking, that are furnished with a large and common Cup, such for Instance, as Poppies and Carnations : There are others which have none, and these are Tulips, Anemonies, and several more. But all Flowers, or at least the greatest Number, have Petals, or Leaves, Pistils, Tops, and Chives. The Leaves are a kind of a Palisade, with which Nature has encompassed the Heart of the Flower,

The Leaves
of a Flower.

to cover it as there may be Occasion. These Flowers open at the Rising of the Sun, to receive the Heat ; and close up, some more, others less, at the Approach of Rain or Night, to keep off Moisture and Cold. For the most Part they form a little Vault, which incloses the Seeds, and seems, with a kind of Consciousness, to preserve the Grains consigned to its Care *. The Petals perform the same Functions to the Flower as the Leaves render to the Plant ; and all the Particles of Air, Water, and Fire, together with the active Salts and Spirits that operate in the Leaves, are insinuated into their Substance, thro' the Pores that open on their Surfaces. The Seed

The Pistil.

is shut up in one or more Pistils, which are so many little Purses placed in the Centre of the Flower. The Chives are Fibres, or little Pillars, which rise to the Height of the Pistils, and sustain the Tops ; and these

The Chives.

The Tops.

Tops are a kind of Pendants, or hollow Shells, filled with a fine Powder of the Nature of Rosin : When they are ripe, they let this Powder fall through different Strainers, into the Cup of the Flower, and particularly on the upper Part of the Pistil, which is shagged with Points, and cover'd with a gummy Juice, as well as pierced with little Holes, that it may the better receive and detain the Powder. The Points and the Oil stop the Grains of this Powder, and the Openings facilitate its Passage to the Seed ; but if these Passages, in the Pistil, are too narrow to admit the Grains of Powder into their Va-

* Perhaps they are the same to Fruits, as the seminal Leaves are to a young Plant.

cuity,

cuity, we may then suppose, that these minute Grains constitute those Inclosures which contain and evacuate a finer and more delicate Substance.

The minute Grains, or globular Particles of Wax, are fixed, perhaps, around the Pistil, and at the Bottom of Flowers, while the Juices or Spirits with which these are impregnated, are transfused, thro' the Pores of the Pistil, to the Grains, which then receive the imparted Fecundity. It is not yet known, whether the Power contains the Buds that are to be insinuated into the Seed, or whether each Seed contains in itself one or more Buds, of which the nearest to the Aperture of the little Purse, is drenched and rendered prolific, by the enlivening Spirit that flows from the Powder. I shall be very cautious of taking any Part in the Disputes of Botanists, and what we have already advanced on the Subject before us, amounts to no more than saying, that the Flower opens only to ripen the the Powder, and that this is the prolific Principle of the Seed.

If immoderate Rains in the Spring should wash away this Powder, no Produce can be expected. When the proper Season for the Flower proves unequal, and either the Rain bears away the Powder, or the Cold shuts up the Orifices of the Caskets that contain the Seeds, few or none of these precious Particles enter into these Caskets or Pistils, the greatest Part of the Seeds continues barren, and the Product is inconsiderable. What I now tell you, is equally true with respect to the Blossoms of the Vine and Corn, as it is with regard to those of Trees and the smallest Plants. But when the Season proves favourable, and only a few Grains of the Powder well ripened should fall into the Orifice of each particular Seed, these all become fruitful, and the Year is attended with Plenty. The other Grains of this Powder, which are innumerable, are not lost, for they furnish the Bees with their Wax, and a Number of Insects resort to them for their Food, or other Conveniencies unknown to us. But the *Chevalier* will have the best Idea of all these things in the Spring of the Year.

The Tulip.

In the Tulip, for Instance, which opens to the Sky, the Chives rise higher than the Pistil,

Pistil, that the Tops may powder it, either by letting fall or suffering the Wind to blow their little Dust upon it : On the contrary, with respect to the Imperial Lilly, whose Cup turns downwards ; and the Common Lilly, and the Honey-suckle, whose Flowers bend extremely, should the Pistil be shorter than the Chives, 'tis evident that the Powder would fall from the Tops to the Earth, and be intirely usefess to the Seed inclosed in the Pistil ; whereas, if the bent Pistil be longer than the Chives, the Dust, in that case, in its Descent from the Tops, will meet with Extremity of the Pistil, and enter into it without any Difficulty ; and this is Nature's Arrangement of the Flowers.

The Imperial Lilly. The Common Lilly. The Honey-suckle.

Chevalier. Here is a Turnsole, Madam, will your Ladyship oblige me with a Sight of the Particulars you have been describing ?

The Turnsole.

Countess. With a great deal of Pleasure, Sir, These large verdant Suns contain as many Pistils as Seeds. Above each particular Seed a little Cup rises, in the middle of which is a kind of Bag of a brown Colour, and full of a yellow Powder : Each of these Bags performs the Office of a Chive and Top to the Seed which is beneath. Thro' the Bag rises a little Tube, whose Bottom joins to the Seed, and its Top is shagged with Hair, for the Preservation of the Powder : This Tube likewise opens at the Top to receive the Powder, and splits into two Points : When it has performed its Office, the Points rise and fold over one another ; after which, they become dry and usefess.

Some Plants are to be seen, in which the common Order of Vegetation is inverted ; as particularly, that Plant whose Leaves are so prodigiously large, and which produces a very purgative Seed, called *Falsè Coffee* ; if you please we will approach it.

Palma Christi.

The Pistils are formed in Clusters, on the Top of the Flowers, and the Packets of Powder are placed below. When these Packets are ripe, and burst, a Steam of Powder rises from them, and diffuses itself thro' the Air. The little red Tufts, in which the Pistils terminate, lengthen, in order to check the Fall of the Powder ; by which

which means the Fruit, contained in the Pistils, receives its Fecundity.

The Fig-Tree. Some Plants have no other Flowers than those of their own Fruit, as the Fig-Tree, where all the Kernels that are in the Fig are charged and accompanied with their Chives, their Tops, and their Powder, under a common Inclosure.

*The Pompion.
The Melon.*

There are other Plants on which we discover two Sorts of Flowers, separated on the same Stem, as Pompions and Melons. Gardeners give the Name of real Flowers, to those which contain the Fruit, and call those false, which inclose their Powder in a Bag placed in the middle of the Flower, and out of which this Powder escapes thro' three or four remarkable Openings. The Gardeners generally pick off these pretended Flowers, which is a very good Method when their Produce is certain, and the Melons are completely formed, because they husband the Sap by this Retrenchment; but they deceive themselves extremely, when they destroy these false Flowers at their first Appearance, because they contain the genial Powders, without which, the other Flowers that produce the Fruit are incapable of any Fertility; and we had once a Gardener, who, by an improper Officiousness, in plucking off these false Flowers deprived us of all the Fruit.

The Gentleman from whom I had all these Particulars, gave me an Opportunity of observing, that several other Plants, as well as the Pompion, had two Sorts of Flowers on the same Stalk; and, during his Continuance here, made us sensible of the Truth of his Observations, which we found to be fact with respect to the Oak, the Filbert-Tree, the Ivy, the Mulberry and Plane-Trees.

He afterward informed us, that other Plants bore the Fruit-Flowers on one Stem, and the Flowers out of which the Pistils spring, on another, of which Sort are the Palm-Tree, the Hop, and several others.

Chevalier. All that her Ladyship has related charms me with Admiration; but I find it difficult to comprehend how the Seeds should be on one Stem, and the Flowers or Powder on another.

Countess.

Countess. This is what I see daily, therefore don't be incredulous.

Chevalier. Why then do they make a Jest of those People, who say Plants are Male and Female ?

Plants Male
and Female.

Countess. Let us take a Walk over the Bridge, to those People who have been gathering Hemp; a single Instance will evince to you the Reality of all the rest. Here are two Sorts of Hemp exposed to the Sun; in one of which you see the Flowers are dried, and it is that which has been gathered for some time; the other is still green, and there you see several Bunches of Seed under the Leaves. The Stalk, which produced the Flower, was the tallest at first, that the Powder which fell from the Flowers might be received by the Seeds, which were then lodged, much lower, on the other Species. The Flower-stems having performed their Functions, begin to wither, and they have been gathered and separated from the others, to keep the People employed, 'till that Produce was compleated.

Chevalier. Madam, I acknowledge myself a Convert.

Countess. Pray let me know, which of these two Species you would call the Male, and which the Female ?

Chevalier. I should call the Male, that Growth which produces the Flowers, and is at present much shorter than the other, and dries first; and I should give the Name of Female, to that which bears the Seeds; and surely this must be the Fact.

Countess. I find you would place Things in a right Order, and, give them their proper Names. But, for all this, the Country People have thought fit to give the Name of Female, to the Hemp which produces the Flowers, and is soonest dry; and they call that the Male which bears the Seed, and for no other reason, but because the Thread they spin from the first Growth is finer, and the other more compact and strong. When you are in their Company, you must talk like them, or they will never understand you: But a Philosopher, or, in other Words, the *Chevalier*, is at liberty to think differently from the Vulgar.

Chevalier.

Chevalier. Your Ladyship will see what a Philosopher I am: I have not the least Knowledge of the Use of this Plant, and don't discover any Similitude between the Hemp in these Fields, and that which I have seen spun and work'd into Cloth: Will your Ladyship be pleased to explain this to me?

Countess. I invite these Gentlemen to entertain the *Chevalier*, to-morrow, with the most curious Plants of which they have any Knowledge; for, amongst such a vast number, they ought to fix on Particulars: And I dare say, they will search all *Asia* and *America*, for every thing singular and uncommon. For my Part, I don't intend to wander far from my own Garden, though I may happen to present you with something more extraordinary than any Plants that are most celebrated by Foreigners, and it shall be nothing but Hemp: This I reserve for my Subject, and our Conversation to-morrow will turn once more on Distaffs.

DIALOGUE XV.

The COUNT, *and* COUNTESS.

The PRIOR, *and*

The CHEVALIER.

Countess. CHEVALIER, it is not any Compliment, when I assure you that the sudden Notice of your Departure gives me a real Concern. The new Alliance in your Family is a very advantageous Affair, and I am sensible it is absolutely necessary for you to assist at the Ceremony; but I flatter myself with the Pleasure of your Company, till the End of *September*, and now all our Schemes are disconcerted: Adieu to Fishing, Hunting, and the new Academy.

Chevalier. The last Article gives me the greatest Pain. One may be entertain'd with Hunting and Fishing in every Place, but I can no where enjoy such Conversation as I am favoured with in this Place.

Count. Ah, *Chevalier*! we are indulging the ceremonious Strain. We must banish all that from our Academy.

Countess. Very well. Your Lordship makes Regulations, when the Academy is at an End.

Count. At an End! I rather take it to be only in its first Establishment, and that our Assembly will be renewed every Year, in *September*. Is not this your Opinion, *Chevalier*?

Chevalier. I am only apprehensive of one Inconvenience; and that is, I shall be wishing eleven Months for *September*.

Count.

Count. Your Disposition is so well known to me, that I am persuaded you will do every thing with Elegance and Taste. That polite Literature to which you are going to devote your Attention, is all together as entertaining and useful as Natural History, which, at present, is not so necessary for you to be instructed in; and I only recommend it, as an Amusement to you in your Vacations. But whilst we are in Expectation of your Return, the *Prior* and myself will sketch out the Subjects of our future Entertainments: I leave the Choice intirely to him, and we may very well depend on his Judgment.

Chevalier, How happy are we in the Country! and indeed we might be so in Town could we enjoy what is to be attained here.

Prior. Let us be more conformable to the Laws of our Society. No Compliments I entreat you. Academies, like ourselves, never meet to admire one another. We come here to be entertained with what her Ladyship promised yesterday.

Countess, You must allow the *Chevalier* to give you this Instance of his obliging Temper, since you are under no Necessity of being in much hurry for the Amusement I promised you; for, in short, it is nothing more than Thread and Hemp.

Prior. We don't think the Subject at all trivial: and whatever is useful to us, is more necessary to be known, than any thing that passes in *Jupiter* or the Moon. The most shining Speculations, and the Choice of Subjects intirely foreign to us, are not attended with the most profitable Consequences: And I am better pleased with * *Monfieur Reaumur*, when he is contriving to destroy the Moths in our Tapestry, and the Vermin in our Houses, with Oil of Turpentine, and the Fumes of Tobacco, than I am with *Monfieur Bernoulli*, wrapp'd up in his Algebra, or *Monfieur Leibnitz*, combining the Benefits and Inconveniencies of possible Worlds. Must we always be a thousand Leagues from the rest of our Fellow-creatures, in order to be rational and learned? For my Part, I think, on the contrary, that a Philosopher cannot make his Studies too intelligible to Mankind, or employ himself in any thing better, than

* *Memoir de l'Acad. de Scienc.* 1728.

acquiring a right Apprehension of those Objects that surround him, and in which he has any particular Interest.

Countess. It is diverting enough in the Flax, and
Prior, to rank me among the Philosophers, Hemp.
 and make what I have to say on Hemp,
 pass for important Learning, when my Observations are
 taken from the Peasants, who, in these Particulars, are
 our Masters: However, I'll undertake the Province, but
 must desire you to remember, this is the Philosophy of a
 Vocation.

Flax may be ranked in the same Class with Hemp; and tho' it be much shorter, and abundantly finer, it is a Plant pretty much of the same Nature, and employed in more beautiful Manufactures. When the Hemp and Flax have been gathered, which is done by plucking them from the Earth, the Stalks are exposed to the Sun, in order to ripen the Seeds, which are afterwards threshed out of the Heads, and then the Stalks are tied up in Bundles, and steep'd in a standing Water (the clearest is always the best): They are fastened to Poles, and left to soak, about fifteen Days. When the Substance of the Stalks is almost rotten, the Bundles are taken out, and well dried. But, instead of steeping the Flax in a standing Water, it is usually exposed to the moist Air of the Night, and the Heat of the Sun, alternately, by which it receives a finer Colour. When the Flax and Hemp are well penetrated, and afterward compleatly dried, they are bruised, by Handfuls, on a Block, with a kind of Mallet; all the Bullen, which is the inward Substance of the Stem, flies off in shivers, by the Force of the Blows, and nothing remains in the Hand of the Beater, but the thin Bark disingaged in large Threads through the whole Length of the Stem. This Parcel of Threads is afterwards hung on a perpendicular Board, and bruised with a wooden Beetle, in order to shake out all the little Straws that may happen to remain in the Bullen. All the gross Parts are now separated from the Stem, and the Threads of the Bark, that remain in the Hand of the Manufacturer, are intirely pure, and receive their Perfection from the Comb; or, in other Words, they are drawn, first through large Cards or Iron Teeth, and afterwards through others that are finer, that they may be purified from whatever may be still too thick and gross. This Refuse is
what

what they call Tow, of which Matches for the Artillery are made, and likewise a thick Yarn for packing Cloths, whose Usefulness is infinite, since they wrap up and preserve the most valuable Commodities, in their Transportation from one Country to another.

When the Hemp has been thus prepared, it is tied up in Bundles, to be sent to the Rope-yards; but if it prove fine, and fit for the Spinster and Weaver, it is formed into Twists; and now we come, at last, to the Distaff and Spindle. You smile, Gentlemen, but I shall soon make you sensible of the Value of what you so much despise. Suppose, only for a Moment, that you were three *Americans*, three *Iroquois*, or, if you think fit, three *Chineses*, no matter which, be so good as not to be offended at the Supposition. What would your Astonishment be, were I to inform you, that our *Europe* produces a little Plant, whose Fruit is an excellent Nourishment to several Birds; affords a kind of Bread good to fatten large Cattle, and produces an Oil that illuminates innumerable Families in the Night; that, instead of the Men, the *European* Women generally work off the Bark of this Plant, and manufacture it into those spreading Sails, by the Aid of which our Ships transport their Merchandize to the remotest Parts of the World, and convey to us whatever we want; that the same Bark is worked into Cables, strong enough to bear the Weight and Force of Anchors, and that Ropes, Pack-thread, and Girths are likewise made of its Materials; that all these are of constant and universal Use in Navigation, Commerce, Husbandry, and domestic Affairs; that, with this very Bark, Houses are made to shelter our Soldiers; that it likewise affords us the finest Ornament for our Tables; that we also form it into a Dress, which accommodates us Day and Night; is perfectly neat and convenient, and contributes as much to the Health of our Bodies, as the *Bath* itself, to which it now succeeds, and from the Trouble and Preparation of which it intirely discharges us; in a Word, that this Bark, according to the different Forms given it by *Europeans* becomes the most ornamental Habit of Kings, and furnishes the Husbandman and Shepherd with a decent Attire, at a very inconsiderable Expence; These are the Benefits we receive from this Plant.

Well

Well then, don't you Gentlemen of the new World believe us very happy in ours, to have Women who are so dextrous at the Spindle and Distaff, and are capable of fashioning this precious Bark?

Prior. For my Part, Madam, I, in the Character of a good *Iroquois*, shall maintain the Honour of our *America*. You boast of your Hemp, and I allow it to be something; but we have three Trees, that are, at least as good as yours; one creeps on Earth, like a Vine; the second is thick, like a bushy Dwarf-Tree: and the third is as tall as an Oak: All the three, after they have produced very beautiful Flowers, are loaded with a Fruit as large as a Walnut, and whose outward Coat is intirely black. This Fruit, when it is fully ripe, opens and discovers a Down extremely white, and which is called Cotton. They separate the Seeds from that, by a Mill, and then spin the Cotton, and prepare it for all Sorts of fine Works, such as Stockings, Waistcoats, Quilts, Tapestry, Curtains, and Conveniencies of every kind. With this they likewise make Muslin, and sometimes mix the Cotton with Wool, sometimes with Silk and Gold itself. After this Account, can your Ladyship still despise our *America*?

Three Sorts of Cotton Trees.

Countess. I am very well pleased with it for producing your Cotton. But are you *Iroquois* the People who prepare it? I believe they are obliged to our Fingers for this.

Count. Since the *Prior*, in the Quality of an *Iroquois*, has taken upon him to be an Advocate for Cotton, I intend, in the Character of a *Chinese*, to make Cotton likewise the Claim of *Asia*, where it is gathered, and where they manufacture it much better than in *Europe*. And I am also to boast of a Plant that is still more admirable; I mean the Aloe of *China*, to which your Part of the World can produce nothing comparable. But our Aloe must not be confounded with that Plant * which bears long pointed Leaves, is so very slow in producing its Flowers, and from which they pretend to gather Silk, and which Plant is commonly one of the Ornaments of our Druggists Shops.

The Aloe of China.

* Diction. Savari. Pom. Hist. des Drogues.

Our Aloe is a Tree as tall as that which bears Olives, and of the same Shape; under its Bark it contains three Sorts of Wood; the first is black, solid and weighty; the second is of a tawny Colour, and as light as rotten Wood; the third, which is at the Heart, has a very strong but agreeable Odour.

The first is called *Eagle-wood*, and is very scarce; the second, Wood of *Calembouc*; it is brought into *Europe*, and esteemed there as an excellent Drug; it burns like Wax, and, when thrown into the Fire, diffuses an aromatic Scent. The Heart, which is called Wood of *Calambac*, or *Tambac*, is more precious in the *Indies*, than Gold itself. It is used for perfuming Habits and Apartments, and is a Cordial in fainting and paralytic Fits. And in this Wood they likewise set some of the most precious Jewels of the *Indies*. These are not the only Advantages of our Aloe: The Leaves of this Tree serve instead of Slates, for covering Houses; they are also formed into the Shape of Dishes and Plates, and when they have been well dried, may be used at Table. When they are stripped of their Nerves and Fibres betimes, these are manufactured into a Thread, used in the same manner as your Hemp. The Points which rise on the Branches, serve for Nails, Darts, and Awls, with which last the *Indians* pierce their Ears, when they design to honour the Devil by some extraordinary Austerities. If any Cavity be made in the Tree by cutting out the Buds, a sweet and vinous Juice flows from the Wound in a prodigious Abundance; it proves a very pleasant Liquor, and, after some Time, changes to an excellent Vinegar. The Wood of the Branches is good to eat, and has the Flavour of a candy'd Citron. The very Roots are likewise useful, and Ropes are frequently made of them. In a Word, a whole Family may be supplied with Food, a Habitation, and Rayment, by an Aloe.

Countess. I confess this is a very valuable Tree, and happy is the Person who can possess one. But History tells us, there are but few of the Species. As to any other Particulars, take all the Aloes together, and join to them every *Cocoa-tree* in the *Indies*, of which such Wonders are still related, and the Whole will be nothing comparable to our Hemp; because those great Trees are a
long

long time in coming to Perfection, and will not grow in every Soil; beside which, they must be destroyed before they can be useful; whereas Hemp thrives in all Places; and as it is sown and gathered every Year, is not only estimable for its excellent Qualities, but still more, for that Abundance which nothing can equal, and which makes it the Delight of the Rich, and the surest Relief to the Poor.

Prior. Let us fairly acknowledge, that her Ladyship, in chusing a Plant the least alluring to the Eye or Curiosity, has fixed upon that which, next to Corn, furnishes Mankind with the greatest Number of real Advantages and Accommodations.

Countess. Let us know, *Chevalier*, what Plant you declare for. You may chuse one that is foreign, or keep to the Growth of your own Country, as you please. You Philosophers are Natives of all Nations.

Chevalier. I should be for the Plant that produces Sugar.

The Sugar
Cane.

Countess. You are very much in the Right. This Plant, which we want, is the Riches of the Country where it grows, and furnishes those to whom it is imported, with a thousand Advantages.

Ibid.

Chevalier. I should be glad to know the Shape of the Plant, and in what manner the Sugar is extracted from it.

Countess. I freely acknowledge I know nothing of the Matter. Put this Question to our *Americans* here, and they will entertain you with several Novelties about it.

Prior. Sugar is properly nothing more than the Salt found in the Juice or Pith of a Reed, cultivated in the *East-Indies*, and still more in *America*. A Sugar-cane, when sunk in a Furrow of Earth, shoots out from each of its Knots, another Cane, which, rising to the Height of seven or eight Feet, produces a Cluster of Leaves very like our Flags, and a Sprig terminating in a Tuft, almost like our common Reeds; ours are only useful, by being sometimes formed into very pretty Distaffs: but the Sugar-cane is impregnated with a delicious Syrup. These Tubes or Canes are bruised under the Beam of a Mill, by

the Labour of those unfortunate Slaves, whom Merchants, that call themselves Christians, buy, like Horses or Oxen, at *Senegal*, and in the Kingdoms of *Guinea*, and *Angola*. The Juice, after this, is boiled successively in five different Kettles, and by the various Changes it undergoes, the Syrup is separated from the essential Salt it contains. It was formerly thought sufficient to begin this Separation, and send the Sugar from the *Indies* to *Rouen*, *Orleans*, and other Places, to be completed: But is now transmitted to us in Loaves, well purified and refined. This is the Origin of Sugar, which we make no Scruple to prefer to Honey, so much esteemed by the Antients. We are no longer in Pain, at the Accidents that may render the Labours of Bees unsuccessful. The vast Regions and Islands in the Heart of the torrid Zone, are annually covered with an Harvest of Canes, out of which the Syrup is first extracted, and afterward that delicate Salt which is now so universally used either to preserve what would not otherwise keep, or to season what would either be insipid without this Expedient, too poignant with our common Salt, or disagreeable by its natural Bitterness.

Chevalier. I am strangely surprised to hear of Salt in a Plant.

Priar. All Plants and Bodies have their Salts. When the Chymists make a Solution of a Body by Fire, they constantly find more or less Salts, in what remains after the Distillation. The Ashes that fall from the Wood we burn, are nothing but the earthy Parts, and the Salt of the Plant which was thrown into the Fire.

Count. I beg we may have no more Talk of Salts and Chymistry till the next Year, and let us not so much as attempt an orderly Detail of Plants in particular: We may one Day take a cursory View of medicinal and aromatic Plants, as well as those proper for making Drinks in daily Use: Let us employ the Moments that are left us this Day, in a slight Examination of those which are most frequently spoken of, and from the Knowledge of which we may receive the greatest Benefit.

Chevalier. I should be glad never to have had any Occasion to be acquainted with *Manna*, *Rhubarb*, *Ipecacuanha*, and *Quinquina*, but I know the Efficacy of these Medicines,

Medicines, tho' I am ignorant of the Country from whence they come.

Count. Manna is a Sugar, or Species of natural Honey, that flows from the Leaves of the Ash-tree in *Calabria*, at the Southern Extremity of *Italy*. These kinds of Fluxions are frequent*. The proper Vessel supplies all Trees with this Fluid; but our *Linden* and *Poplar* Trees are all covered, especially in the Spring, with a gummy Juice that transpires thro' the Pores of their sprouting Leaves; it has a charming Odour, which seems, by its Agreeableness, to promise us something advantageous; and perhaps, the Experience of it may one Day prompt us to use it. 'Tis an Opinion which begins to prevail, and cannot be too popular, that God has stored every Country with Remedies for the Distempers incident to it, and that we have a Multitude of Plants around us, that tender us their Services; and perhaps had we less Inattention and Impatience, we might have no occasion to resort to foreign Remedies, which are always dear, and often impaired by Age, as well as adulterated and converted into Poison, by the Avarice of the Merchants. But whilst we are waiting for repeated Experiments and Discoveries, it must be allowed, that we have no better Remedies than those the *Chevalier* has named, and their Success in some Distempers is almost infallible.

Rhubarb is the Root of a small Tree, that grows only in *Asia*, and especially in *Tartary*. That of *America*, which has been thought to be of the same Nature, has not been as yet sufficiently proved.

Ipecacuanha is the Root of a Tree, to be found in no Country but *Brazil*.

Quinquina is the Bark of a Tree that grows in *Peru*. In several Countries it is called *Jesuits Bark*, because we are indebted to those Fathers for this precious Remedy. Sir——*Talbot*, an English Gentleman, has made it much more useful and common

* Savari Dict.

than it was formerly, by the manner in which he has taught us to prepare it.

They now begin to use the Bark of a Tree in *Cayenne*, called *Simaruba*, and we are informed for certain, that it presently suppresses the most inveterate *Dysenteries*.

These four Remedies, so efficacious, and justly esteemed, are only the Roots and Barks of some particular Trees. After the proper Juice they are capable of containing, we can have no Conception of any thing more than a little Vessels, Fibres, and Air-vents; or, in other Words, a System of Vessels appointed for the Filtration or Passage of Juices extremely subtle. I am apt to suspect, that these Barks and Roots, when reduced to Powder, and received into the Body, are only like a Number of little Sponges, whose Pores and Orifices are proportioned to the extraordinary Smallness of the Acids, which disorder and afflict the Patient. These Acids insinuating, or rather sheathing themselves in the Sponges, opened wide enough for their Reception, and sufficiently compact to retain them; the Acids, Sponges, and Indisposition, are all carried off, and dissipated by Degrees. This first Suspicion, that seems to have some Probability, makes me entertain a second, which is that we may find in our own Country, a Root or Bark, which would produce the same Effects.

Pier. The Root of our *Gentian* is no way inferior to the Jesuit's Bark, in Intermitting Fevers: And be pleased to take Notice, I am still speaking of a Root.

Count. 'Tis to be hoped some future Experiments will discover to us our own Riches.

Countess. Gentlemen, you are treating Physic in a very rational manner; but there are Plants, whose Use and Efficacy are more agreeable. And I desire to know from whence we have those Drinks or Infusions that are become so fashionable, I mean *Tea*, *Coffee*, and *Chocolate*.

Count. Tea is nothing more than the Leaf of a Tree, that grows only in *China*, and *Japan*. The Tea-Leaves, when steeped in warm Water, and corrected in their Bitterness, by a small

Quantity of Sugar, diffuse the Scent of a Violet, and a Volatility which, in some measure, refreshes the Brain, and besides the Qualities, it has the Reputation of being an *Aperient*.

Coffee is a little Berry, gathered from a Tree in *Arabia Felix*, * towards *Aden* and *Mocha*; and they now begin to cultivate it, with Success, in the Parts adjacent to *Batavia*, and in the the Isle of *Bourbon* near *Madagascar*, which belongs to the *French*.

Chocolate, which is diluted in warm Water, in order to make a nourishing Liquor, is a Paste whose chief Ingredient is the Powder of *Cocoa-nuts*, which are taken out of a long Shell, shaped like a *Cucumber*; and to these Nuts there is an additional Mixture of some particular Drugs. The * *Mexicans*, in whose Country the *Cocoa-trees* grow in the greatest abundance, take the Nuts and mix them with *Indian Corn*, and such Sugar as they extract from their Canes, adding a few Seeds of the *Rocou*, which are coloured with the finest *Vermilion* in the World. They grind all these Ingredients between a Couple of Stones, and work the Mixture into a Paste, which they eat dry when they are hungry, and dissolve it in warm Water, when they would quench their Thirst.

The *Spaniards*, who find this Composition very beneficial and acceptable, and know it to be a Commodity of a sure Consumption, are so industrious to bring it to Perfection, and make it extremely valuable, that, at present, a small Garden planted with *Cocoa-trees*, is worth above twenty thousand Crowns to the Proprietor. Complaints are made, that *Spaniards* mix with the *Cocoa-nuts*, too great a Quantity of *Cloves* and *Cinamon*, beside other Drugs without Number. The Grocers in *Paris* use few or none of these Ingredients, and have much less Regard for *Musk* and *Ambergrease*, which a Number of People are fond of to Infatuation; they only chuse out the best Nuts, which are called *Carracca*, because they are brought from the Parts adjoining to the City of *Carraccos* in *Terra Firma*; with these Nuts they mix a very small Quantity of *Cinamon*,

* Savari.

the freshest *Vanilla*, and the finest Sugar, but very seldom any *Cloves*; and they now have the Art of making such Chocolate, as is universally esteemed.

Chevalier. I know nothing of the *Vanilla* his Lordship has mentioned; and am as much to seek with respect to *Cinamon* and *Cloves*.

Count. *Vanilla* is a Shell full of a luscious Juice, and little black Seeds of most agreeable Odour. It is gathered in *America*, and especially *New Spain*, from a Tree of the same Name.

Cinamon.

Cinamon is the Bark of a Tree found only in the Island of *Ceylon*. The *Dutch* have destroyed it in every other Place, and monopolized the Commerce of it to themselves. When the Fruit of the *Cinamon* Tree is boiled in Water, it produces an Oil, which fixes and thickens like Tallow, in proportion as the Water cools: Of this Oil they make Candles perfectly white, and reserve them for the King of *Ceylon*. There is also the white *Cinamon* of *St. Domingo* and the *Antilles*; but it is little esteemed.

The *Clove*.

The *Clove* is a small aromatic Fruit, shaped like a Nail, with a Point and a Head divided into four Quarters. It grows on the *Clove* Tree, in the Island of *Ternate*†. This Tree was once very common in all the *Moluccoes*; and every Nation furnished themselves with *Cloves* at Liberty. But the *Dutch*, whose Patience the greatest Obstacles could never weary, have either engaged or constrained the Natives of these Islands, to destroy all the *Clove* Trees, except those in *Ternate*, where the *Dutch* are Masters. They have likewise the best Settlements in those Countries that produce *Pepper*, *Nutmegs*, and *Mace*; which last is the Shell of the *Nutmeg*, and much more esteemed than the Nut itself: So that, by these means, the *Dutch* are become the Medium of this kind of Traffic, to almost all *Asia* and *Europe*. And thus you see, in a few Words, the Origin of our fashionable Infusions and best Spices.

Countess. I am dissatisfied with some Circumstances in these *Indian* and *Turkish* Liquors, which prevail so

* Journ. des Scav. Jan. II. 1684.

† A small Island lying Westward of Gilolo in the *Moluccoes*.

much among us; one is, the Necessity of preparing them every Time you intend to use them: And the other is the Difficulty of preserving the proper Ingredients of this Preparation. They all evaporate and lose their Spirits, and we must be constantly renewing our Stock.

Count. On the other hand, 'tis the Privilege of our best Liquors, to retain their Perfection many Years: *Burgundy* preserves its Excellence even in *Persia*, where *Tavernier* presented some to the Sophy, who preferred it to his Wine of *Schiras*: *Champagne*, which *Mons. St. Evremond*, who in Matters of Pleasure was undoubtedly a good Judge, called the best Wine in the Universe, is preserved in Bottles nine or ten Years, and even more, when it happens to be rightly managed.

Prior. If our *European* Liquors keep longer than those of *Asia*, 'tis the very *Corn*. same with our *Corn*, compared either with the *Magnoc* Root, of which the *Americans* make their Bread, or the Pith of *Sago*, which serves for Bread, in all the *Moluccoes*, or indeed, with all the Plants, which the Natives of different Countries have endeavoured to substitute in the room of Bread. We ought to offer up our Gratitude to the Deity, for a Nourishment the most perfect in its Kind, and whose Production and Preservation are most easily accomplished. When *Corn* is well managed, it may be kept an hundred Years and longer, if such be the Intention.

Chevalier. An hundred Years! I have known *Corn* grow bad in less than three. What Method then must be taken to preserve it?

Count. At first, it must be removed every * fifteen Days, for at least six Months successively, if you intend to preserve it; after this, it must be removed once a Month, or not quite so often. They shift it from Place to Place with a Shovel, that the Dust, Impurities, and heated Air may be dispersed. When the *Corn*, by this Proceeding, has exhaled all its fiery Particles, it may be kept as long as you please, provided the Root of the Granary be of a reasonable Height, and all Humidity excluded. But in order to frustrate all bad Impressions of the Air, and prevent the

* *Memoir. de l'Acad. des Scienc. 1708.*

Entrance of Vermin, who grow as numerous as the Corn itself, and dig, each of them, an Habitation in every Grain, the most effectual Method is to spread a little unslaked Lime over the Heap, and sprinkle it lightly with Water; the Particles of Fire, inclosed in this calcined Stone, escape through the Apertures made by the Water; the Lime melts, and changes into a Jelly of a perfect Whiteness: It then insinuates itself through the whole Surface of the Corn, two Fingers in Depth; and this Mixture of the Grains and Jelly forms a Crust, which prevents the Corn from taking Air, as well as over-heating and shooting forth.

Prior. In the Year 1707, they opened, in the Citadel of * *Mentz*, a Magazine of Corn which had been stored up in 1578, and the Bread that was made of it proved very good. When the *Abbé de Louvois* travelled to the Frontiers of *Champagne*, as he was one of the most judicious Men in the World, and indefatigable in his Endeavours to be informed of each Particular that related to the Arts and Sciences, he visited all Parts, and had everywhere a favourable Admission. They shewed him, in the Castle of *Sedan*, a Heap of Corn which had been lodged there an hundred and ten Years, and preserved notwithstanding the Humidity of the Place, which at first made it sprout above a Foot deep. The Leaves, and first Shoots of the Stems, which had already risen to the Height of a Foot, wanting Air, began to rot, and sunk down upon their Roots; and this glutinous Compost, incorporating with the Grains beneath, and growing dry hardened into a very thick Crust, which preserved the rest of the Heap. Some of the Bread, made of this Corn, was sent to Court and proved extraordinary good.

Chevalier. If this be the Case, we never need be apprehensive of Famine. When the Harvest is plentiful, a Quantity of Corn might be stored up, and then we should not be obliged, in Years of Scarcity, to purchase it from foreign Countries, at an extravagant Price.

Count. This Precaution is taken by the *Dutch*, who have always a double Provision. But the Attempt might seem very great, for such a Kingdom at *France*, tho', at

* *Memoir. de l'Acad. des Scienc. 1708.*

the same time, it must be acknowledged, that were this Expence once made, it would secure the Indigent from enhanced Prices, and the Rich from Insults; and, by keeping off a Famine, would preserve us from the greatest of all Calamities, because it never fails to carry off one Part of the Inhabitants, and always exposes the other to the Dangers of Sedition, and contagious Distempers.

Prior. The Precantion you mention would not only prevent the Mischief, but even dissipate the Apprehensions of it, which are sometimes as terrible as the Calamity itself. Two or three Moons, unfavourable to the Fruits of the Earth, are alone sufficient to shut up all the Granaries, and introduce a Famine, when there is even a real Plenty; and then the Disorder and Alarms will be universal, and incapable of Mitigation or Controul, by the utmost of human Wisdom; whereas one Magazine of Corn, wisely raised and regulated, in every Canton of the Kingdom, would intirely prevent all these Disasters.

Count. These plausible Projects are easily formed, by such speculative People as ourselves, who know nothing of the Necessities of State. The Affair has been frequently proposed, always relished, and as constantly obstructed by several Accidents: For our Parts, we have only to express our Wishes in this Particular; and as to the rest, must repose our Confidence in the Wisdom of the Government. Instead of regulating the State, let us adjust our Plants, from which we have made a little Digression.

Countess. I advise you, Gentlemen, to keep to what has been said: But to put the *Chevalier* into a Condition of knowing much more than he can learn from you, in the little time we are to be together, I will give him this good Counsel: After his Return to *Paris*, let him frequently make his Court to the Directors of the Royal Gardens; his Eyes and Ears will be constantly entertained with real Curiosities. Of all Employments, none is more simple, and natural to Mankind, or more amusing than the Cultivation of Plants. For my part, I am so delighted with it, that I never pass a Day, without walking round my Parterres, and Kitchen Garden; I have there daily Discoveries of some agreeable Novelty; both the Mind and Body equally find their Account in this Exercise; and,

to inspire the *Chevalier* with an Inclination to it, I must inform him, that the Culture of Plants is equally noble and entertaining: It has constantly had Charms for Kings, as well as Subjects; and 'tis now very common to see Men of the first Quality, in *England* and *France*, applying themselves to Gardening and Husbandry, and the proper Methods of bringing both to Perfection.

Prior. It is a known Fact, that, at present, the most polite and understanding People make their Garden, not only a Pleasure, but a serious Affair. The Art of managing a Kitchen Garden especially, was never carried to a greater Height; and we see some of these, where the Eyes are as much delighted with the Propriety of the Cultivation, as they are with the most regular Parterre, and where the Discovery of a thousand new Secrets, for improving the Fertility of Plants, and perhaps making the Species more diversify'd, must produce Pleasures incomparably more entertaining than any that the regular Shape of Yew or Box-Trees formerly afforded. This Taste does Honour to the present Age, and makes it evident, that we have not always a Contempt for what is solid, but can be rational in our very Pleasures. I however wish the Cultivation of Plants were, like true Piety, freed from every vain Scruple, and disencumber'd of each superstitious Practice. People

An Enquiry
whether the
Moon has any
Influence over
Plants.

are as much infatuated as ever, with the Influences of the Moon and Planets, over Husbandry and Gardening, and, with the greatest Regularity, forbear either to plant or fell, in the Wane of the Moon. Deep Study has assigned particular Days for that Employment, and the Knowledge of these disagreeable Practices, frequently constitutes the whole Abilities of some impertinent Gardeners, though, at the same time, the Falshood of those pretended Rules is daily evinced by a thousand Experiences, and the Gardeners, themselves must needs be sensible of their Insignificance: But when a Plant happens to succeed well, they congratulate themselves, for having chosen a proper Day for its Plantation, and the Time of the Moon must be set down amongst their Maxims; and whenever the same Plant, sowed or planted by their Neighbour at a very different Time, thrives bet-
ter

ter than their own, they immediately impute this to the Soil, Air and Winds; in which indeed they are reasonable enough; but then they still retain their old idolatrous Respect for the Moon.

Count. You atone for the Offence you gave me a Month or two ago, when you talked of Moons unfavourable to the Fruits of the Earth.

Prior. I spoke the usual Language, but joined to it very different Ideas. As the Continuance of Winds, that operate so powerfully on the Productions of the Earth, and even our Bodies, is commodiously measured by the Duration of the *Phases*, or various Appearances of the Moon; and as we say the first Quarter has been rainy, and the second hot, we are therefore apt to ascribe that to the Moon, which, in reality, proceeds only from the Air.

Count. I lately was shewn the very same Remark, in a Letter written by *Monf. Normand*, who has the Direction of the King's Fruit and Herb-Gardens; where it is asserted in express Terms, which I still remember, "That from a vast Number of Experiments, made with the greatest Exactness, and in different Years, on all the Operations of Gardening, he had never met with one that favoured the Subjection of our Fathers to the different Aspects of the Moon." The Authority of such a Man, who joins the politest Literature, and the justest Taste, to a most consummate Experience, made a greater Impression on me, than all the Harangues of a thousand pretended Connoisseurs. It was the Opinion too of *Monf. Quintnie* his Predecessor, that nothing was more frivolous, than to amuse one's self with observing the Day of the Moon, when we intended either to plant or fell; that in reality we ought to do every thing in its proper Season, and chuse a favourable Period, in the best Manner we are able, and then wait for the Success; not from the Day we have chosen, but from the Operation of the Sun, and the Dispositions of the Air and Atmosphere.

Chevalier. Since the Influence of the Sun and Winds is so well known, why do People then so obstinately ascribe Effects to the Moon, whose Operations are imperceptible?

Prior. 'Tis an old Prepossession, and a true Remainder of the antient Idolatry. The first Men who regulated the

Year after the Deluge, made use of a Method extremely commodious, and intelligible to all the World, in order to adjust the different Portions of the Year, and the Labours peculiar to each Season. They chose the various Appearances of the Moon; and as they always had Recourse to this Planet, to fix the Time of their Labours, they began, by Degrees, to imagine that even these were influenced by it; and then, ascribing new Efficacy to her, in proportion as she approached to the Full, they at last became persuaded, that what they sowed, either in the Increase, or Full of the Moon, was impregnated with more Vigour; and, on the contrary, what they sowed in the Wane, corresponded with the Moon's pretended Imbecillity. Crabs and Oysters being frequently observed to be fat, and in a good Condition at the Full, gave them, as they imagined, an Opportunity of improving the Growth and Vigour of these Creatures into a Rule and Proverb, which a thousand Experiments have since refuted to no Purpose. And as bad Winds sometimes happen to blow in the Wane of the Moon, this Circumstance was sufficient to bring that Period into Disreputation; for which Reason it continues to be unfavourably thought of to this Day.

Count. But what do you say of the Stars; and why were they imagined to have so much Force and Influence over us, that several People even now ascribe to them, all the Good and Evil which fall to our Lot?

Prior. This has been occasioned by much such another Mistake as the former. The various Situations of the Sun, who is placed, sometimes in one Constellation, sometimes in another, have induced People to impute to those very Constellations, any excessive Heats, Rain or Winds, that happened under these different Aspects. They afterwards proceeded to search for the very Original and Fate of every natural Transaction in the different Situations of the Plants, and the Aspect of such and such a particular Star. And this it is which has swelled the Works of the Antients, and especially those relating to Agriculture, with so many useless Observations and false Maxims. The *Georgics* of *Virgil*, which we may call the most compleat Piece remaining of Pagan Antiquity, are disfigured by an hundred frivolous Remarks on the
good

good or bad Qualities of some particular Days of the Week or Moon, and on the Variations of the Air; which the Poet boldly ascribes, sometimes to the Aspect of the *Dag-Star*, sometimes to the Setting of the *Pleiades*, or the Rising of *Orion* or the *Kids*; tho' the contrary frequently happened, as it does now. The best Excuse in his Favour is, that 'tis impossible to express in finer Modulations of Verse, those false but popular Ideas to which he was enslaved by Education.

Chevalier. Since we are got among the celestial Animals, who have been thought to act so powerfully on those Plants and Animals that cover the Earth, permit me to ask you, why the Names and Figures of Animals were ascribed to the Stars? What is the Origin of the *Ram*, the *Bull*, and all the rest I have seen in the *Zodiac*? I have been told their Names and Situations, but was never instructed in the Reason of these things, which I always thought extraordinary, tho' I daily hear them mentioned.

Prior. 'Tis not easy to give you full Satisfaction, with respect to this odd Language, which seems to have been introduced among Men, from the eldest Antiquity. Some Distinction must however be made, and we are not to form the same Judgment of the Names of the Twelve Signs of the *Zodiac*, as we do of the other Constellations of the *Sphere*. The Learned are of Opinion, that the *Egyptians* gave to the Twelve Signs, the Names of as many different Animals; and this they did, according to their Custom of disguising remarkable things, under the Symbol or Form of some Animal, or known Object that had any Relation to the thing concealed: For Instance, I am very much tempted to believe, they represented God and his Attributes; such as his Immenfity, and Omnipotence, his Fecundity, and Purity, under the Symbol of the Sun; and that they represented Nature, or Matter, which is intirely dependent on the Deity, and perpetually diversified, under the Image of the Moon, which derives its Light from the Sun, and constantly varies its Appearance; and this perhaps might be one of the principal Causes of Idolatry; Men, by degrees, growing forgetful of God, and confining their Attention to the Sun

Sun, or even considering it as his Representative. But, however the Fact may be, it is certain, the *Egyptians* were extremely devoted to *Hieroglyphics*, and the Twelve Portions of the *Zodiac* were always called by the Name of different Animals, intirely conformable to the *Egyptian* Method and Taste; and they are capable of some reasonable Explications. But for the Generality of the other Stars of the Sphere, *Greece*, in mere Fancy, assigned Names to them, but for what Reasons, we must not attempt to discover. The *Greeks* imitated the *Egyptians*, in giving Names of Men or Animals to the Stars; with this Difference, that the old *Egyptians* gave symbolical Names to some Stars, on Account of a certain Conformity between the Symbol and the Constellation; whereas the *Grecians*, who were unacquainted with this Similitude, and struck with Admiration at the Oriental Wisdom, though, at the same time, they had a depraved Taste for Fable; invented a hundred wretched Conceits concerning the Origin of the Animals of the *Zodiac*, and applied to the other Stars, the Names of Heroes and Animals most known in their ridiculous Metamorphoses.

Chevalier. Let us leave the *Greeks* with their Fables: but what Reasons could the *Egyptians* have, for calling one Set of Stars the Crab, another the Lion, the Virgin, or the Fishes?

Prior. The old *Egyptians*, after they had observed the four natural Portions of the Year, saw that the Sun, in each of those Seasons, was placed, successively, under different Stars. For the greater Exactness then, and to parcel out the Year in a commodious and invariable manner, they divided each of the four Seasons by three Cantons of different Stars; and the whole Year into twelve Houses, or Stations of the Sun, to which they gave the Names of twelve Animals, who were relative to what passed on Earth, in every one of those Portions of the Year.

The Sun, in Spring, covers the Earth with Blessings; and those which the Antients were most desirous of obtaining, and for which they had the greatest Regard, were Sheep, Kine, and Goats. To adumbrate the Benefits and Fecundity restored to them by the Spring, they gave to the three Constellations, through which the Sun took his Progress.

gress in that Season, the Names of these three Animals. The first Constellation under which the Sun is discovered at the Close of Winter, when the Days and Nights are equal, had the Title of the first Animal who is commonly born at that Period, I mean the Lamb, or the Parent of that Creature, who is the Ram. To the second, ^{Aries, or the} they gave the Name of the Bull: And as ^{Ram, Taurus,} the Goats, who are hot in November, and ^{or the Bull,} pregnant for the Space of five Months, bring forth, at the Expiration of that time, two young ones, for the Generality, they assigned to this third ^{Gemini, or} Constellation of the Spring, the Name of ^{the Twins.} the Twins, or Kids, instead of which the *Greeks*, without the least Reason, have substituted the two Brothers *Castor* and *Pollux*.

When the Sun is arrived at the Summer Solstice, he discontinues his Progress towards the Pole, and returns with a retrograde Motion to the Equator; for which Reason, the *Egyptians*, thought fit to appropriate the ^{Cancer, or the} Name of the Crab to the Stars under which ^{Crab.} he then appears; every one knows the March of this Animal, and nothing could more properly intimate the Retrogradation of the Sun. The excessive Heats that follow, cause that Luminary to be then thought in his full Vigour, which they delineated, by giving the Constellation under which he then moves, ^{Leo, or the} the Name of the Lion, the most formidable ^{Lion.} of all Animals. The Harvest which immediately succeeds, made the sixth Constellation be characterized by the Figure of a ^{Virgo, or the} young Female Reaper, bearing an Ear of ^{Virgin, or Ear} Corn. ^{of Corn.} The Symbol is taken from those young Damsels, who gained their Living by gleaning after the Reapers; and nothing could better mark out that Season of the Year, when Providence supplies the Rich and Poor with their necessary Provisions. The *Chevalier* will be pleased to take notice, that the Ear of Corn which she has in her Hand, is called *Shibboleth* in the *Hebrew* Language, and in the *Arabic*, *Sibbul* or *Sibbula* — *Hebrew* and *Arabic*! What Conversation is this? Let us defer it to the next Year.

Counts.

Countess. I must intreat you, Sir, to proceed, you are a going to discover us the Origin of the *Sibyls*, and I have as much Curiosity as another Person.

Prior. The Name of the Ear of Corn, or *Sibyl*, was given to the Virgin herself who carried it, and nothing can be more simple than this Name, in its Original. But Fables afterward came into Fashion, and a History was formed out of what was only designed for a Symbol. It was pretended, that this *Sibyl* had been conveyed from the Earth into Heaven; and to qualify her for the Journey, they furnished her with Wings, in the Figures by which they represented her, and did not forget to affirm, that the Spirit of God was infused into her, and that she foretold Years of Plenty and Sterility. From hence came the *Erythraean Sibyl*; and the History of those of *Persia* and *Cuma* was cast in the same Mould. All those Women or Priestesses, who took upon them to divine or collect Prophecies, as well those that were antient and true, as such that were modern and false, became so many *Sibyls*: But we have dwelt too long on this Subject, let us return to our Constellations.

That under which the Equinox, which equals Day and Night, happens, could not be expressed by any thing better than the Idea of a Balance in *Equilibrio*. The Distempers

Libra, or the Balance.

Scorpio, or the Scorpion.

Sagittarius, or the Archer.

caused by the Sun in his Retreat, or which break out at the middle of Autumn, gave the next Set of Stars the Name of the *Scorpion*, because this Animal bears a Sting and a Bag of Poison in the Tail, and uses both in his Flight. The *Sagittary*, or Archer, who comes next, has a Relation to Hunting, which is a Diversion chiefly followed after the Fall of the Leaf. The *Greeks*, instead of a Hunter, have substituted the fabulous Idea of a *Centaur*. As the Crab, who marches backward, represented the Summer Solstice, after which the Sun always returns to the Equator; so, on the contrary, in order to describe the Winter Solstice, after which the Sun ascends, and continues mounting to the other

Capricorn, or the Goat.

Tropic, the Name of the Goat or *Capricorn* was chosen, because these Animals generally climb when they are feeding, and, as they ascend, always continue browsing, till they have gain'd

gain'd the Summit of Rocks and Mountains.
The Water-Pot may very well represent ^{Aquaries, or} the Water-Pot.
Rains and Snows, and the melancholy Sea-
son of Winter; and lastly the two Fish, ^{Pisces, or the} Fish.
which are united by a Band, seem to relate
to the Generation of those Animals, who appear about
the End of Winter, at which Season the Fishery begins to
be good.

Pardon the Liberty with which I have offered you my
Conjectures. I am sensible all of them are not equally
satisfactory.

Count. Your Explications have an Air of Probability,
and though they should not happen to be all equally hap-
py, 'tis sufficient there are some which are natural and
agreeable to Reason, and capable of making us compre-
hend, that some such Conformities as these, gave the An-
tients an Opportunity of naming the Twelve Signs of the
Zodiac in the manner they have done, which, at one
Stroke, saps all the Foundations of judicial Astrology, and
the superstitious Practices in Husbandry.

Chevalier. I am going to add all this to the Memoran-
dums I have taken of our past Conversations, and shall
beg the Favour of the Prior to revise the Whole, this Af-
ternoon and To-morrow, before my Departure; for I in-
tend to communicate to my Friends all I have learned
here.

Countess. Chevalier, if you will oblige us with your
Company the next Vacation, I promise you a second
Volume, if the Prior and his Lordship will be my Sure-
ties.

LETTER

FROM THE

Chevalier DU BREUIL,

TO

Monf. the Prior DE JONVAL.

S I R,

I Have been this Moment been writing to the Count and Countess of Jonval, to express a thousand Acknowledgments to them for the obliging Reception they gave me, and principally for their charming Conversations; and now permit me, my dear Prior, to testify my perfect Gratitude to you. The most delightful Days of my Life were those I lately passed in your Company. You have led me into another World, altogether enchanting. Till then, I beheld all Objects like a Child, but you have taught me to see with my own Eyes, to know whatever is made for me, and to enjoy my due Prerogative. I have imparted the Pleasures of my Vacation to my Brother and his young Spouse. All our Family begin to be Philosophers, and every Thing engages our Attention. We have a great deal to say, on whatever is presented to us in our Walks, or served up at Table. The Shell of an Oyster, or the Coat

Coat of a Nut, employs us for several Hours. We are endeavouring to discover the Original, the Structure and Use of every Thing we see. But we had yesterday a Dispute on this Subject with our Neighbour the Colonel, and I must now acquaint you with the Particulars. He pretended, that our Application to Natural History, was only lost Time, and all our Knowledge a Set of Misapprehensions and Uncertainties; that we might have a tolerable Idea, for Instance, of some of the larger Vessels which contribute to the Nourishment of an Animal's Body, but that we could never distinguish the other Vessels necessary to support those, and, much less, discover the Texture of the smallest; and yet, according to him, the Knowledge of the one was insignificant, without an Acquaintance with the other; and therefore, that it was of no consequence to begin a Work, and enter into a Track of Inquiries, when we were very sensible we should never complete our Design. Tho' the Colonel's Discourse had no great Authority with us, I was willing however to hear my Brother refute such a Train of Reasoning, and desired him to tell me, if it made any Impression upon him, and whether he imagined he had lost an Object, that a little Mist had render'd obscure to us: I added, with a Smile, that the first Year I was at *Paris*, I had a Prospect, from my Apartment, of the Dome of the *Invalids*, and that when there happened to be any Fog, I could not imagine what became of the Dome, and fancied it was no longer in being, because I could not discover it at that time. My Brother, warmed with my Comparison, renewed the Dispute, and maintained, against the Colonel, that these Difficulties neither destroy'd the Certainty of what we already knew, nor the Facility of acquiring additional Informations; that indeed, some things were concealed from us, but they did not, for all that, prevent others from being sufficiently evident and certain, and that we were not to exercise ourselves in Inquiries that surpass our Faculties, but in those adapted to our Capacity.

This Answer, which was judged to be very judicious, is the same, my dear *Prior*, which I heard from you, in a Conversation wherein you intimated the Rights and Limits of Reason. I was exceedingly affected with all you were
then

then pleased to tell us, and should esteem myself extremely obliged to you, if you would give yourself the Trouble to write down the same Particulars, and transmit them to me at a convenient Opportunity. You have already taught me to think, and must now instruct me to think justly. My Brother, who has seen my Letter, and made some Additions to it, especially in what relates to himself, pays you a thousand Respects, and joins his Intreaties with mine, that we may be indebted to you, for an Illustration of the Subject I have proposed to you.

We have no Intention to make the Colonel a Convert; since we should only find our Labour ineffectual; but we are desirous of being preserved from his Misapprehensions.

A

It is no longer necessary to inform you with a favour-
 able idea of the advantages resulting from the Arts and
 Sciences, in order to excite your Curiosity: That Axiom
 is already comprehended, and I am sensible, the Desire of
 Knowledge is, at the least, your most prevailing Passion.
 And then, this Passion, so commendable in itself, and so
 necessary to the happy Consequence, when it happens to be
 well regulated, may, like several others, be indulged to an
 excessive Degree. We see some Persons, who, without
 any solidify, are only elated by Knowledge, and
 are, in a manner, of vanity, it may be justly said, that
 they are better for themselves and others, as all their
 efforts are directed to their original Ignorance, and not aimed at
 by converting the Life of Reason into
 they are seen to be

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LETTER

FROM THE

Prior DE JONVAL,

TO THE

Chevalier DU BREUIL,

On the Extent and Bounds of REASON.

SIR,

IT is no longer necessary to inspire you with a favourable Idea of the Advantages resulting from the Arts and Sciences, in order to excite your Curiosity: That Affair is already completed, and I am sensible, the Desire of Knowledge is, at present, your most prevailing Passion: But then this Passion, so commendable in itself, and so fertile in its happy Consequences, when it happens to be well regulated, may, like several others, be indulged to an immoderate Degree. We see some Persons, who, instead of acquiring Solidity, are only elated by Knowledge; and there are learned Men, of whom it may be justly said, that it had been better for themselves and others, had they continued in their original Ignorance, and not abused their Attainments, by perverting the Use of Reason in the manner they are seen to practise.

Curiosity

Curiosity is, without Dispute, a laudable Qualification; and no reasonable Person will contradict that Truth: But still this Curiosity must be conducted with Moderation, and we ought to be acquainted with its Limits, in order to confine it within their Circumscription: And this is the Subject, which, in Obedience to your Request, I now propose to examine. This Essay, my dear *Chevalier*, may seem to you a little abstracted, and not so intelligible as our former Conversations. But let me advise you, at your first reading what I have now to offer, to consider it only as a History, without giving yourself any great Perplexity to comprehend every Particular. At the second reading, you will find it more familiar; at least the worst that can happen, will be for you to place this Letter at the End of the Journal of our Conversations, after you have communicated it to your Brother, and to defer reading it anew, till you have made some farther Advances in Philosophy.

The Bounds
of Reason.

The Bounds of Curiosity are undoubtedly the same with those prescribed to the Reason of Man in general, and to the State of each Individual; but, for want of knowing the Measure and Intention of our Reason, we frequently deceive ourselves, in the Choice of Things we desire to know, as well as in the Degree of Perspicuity to which we would willingly extend our Knowledge. It is, however, of infinite Importance to us, not to entertain wrong Apprehensions on this Occasion, and to make a just Estimate of the Power and Incapacity of Reason. The Knowledge of what this Faculty can accomplish, may animate our Endeavours; and our Persuasion of its Inability, in other Instances, may save us the pains of many unprofitable Attempts. But it is a common Misfortune, and especially among young Persons, either not to be sufficiently sensible of the just Value and Prerogatives of Reason, or else to entertain too advantageous an Idea of its Power; in consequence of which, they either totally neglect it, or endeavour to extend it beyond its Limits.

We are, in this Age, surrounded with Dangers. The Fickleness of Constitution; the Constraint of Attention; the enchanting Aspect of Pleasures; the seducing Power of Example, a thousand Causes may degrade Reason in our Opinion, and deprive us of the Efficacy of that Privilege which

which constitutes the Glory and Happiness of Man. On the other hand, the Desire of improving our Understandings, the amiable Success of some learned Men; the Honours and Advantages that attend the Sciences; the Pleasure inseparable from Study; our proper Talents, as well as our inconsiderate Complaisance to ourselves, when we are unacquainted with the Bounds of those Faculties, may lead us into presumptuous Inquiries, that either bewilder us by degrees, or tend to excite in us criminal Expostulations on the Infirmary of our Nature.

The Learned themselves, to whom we confidently apply, as our Guides, in a Track they ought to know better than ourselves, may be the first who contribute to our Illusion. Some of them, more fertile in Perplexities than clear Principles, are wavering in a constant and universal Hesitation. They discourage us in our Searches after Truth, and we are astonished to find so much Uncertainty united to so much Wit. Their Example seduces others, who, despairing to attain any satisfactory Knowledge, resign themselves, in consequence of that Persuasion, to Pleasure, to Insignificance, and a Scepticism of Mind, which is more remediless than Immorality itself. Others, on the contrary, flatter us with Promises, by much too magnificent: They inspire us with an immoderate Opinion of the Extent of our Reason, and subject every thing to their own Examination. They are never perplexed in their Inquiries; and, to hear their Discourse, you would imagine they had penetrated through all the Mysteries of Spirituality and Matter. With a single Turn of Hand, they disconcert the whole corporeal System, and range it anew as they think proper. They are the Partisans of a System of Imagination that comprehends the Universe; they discover the full Play of those mighty Springs that give Motion to the World, and know the Fabric of the minutest Parts that compose it. They speak of every Particular, and give a bold Solution of the Whole.

But, alas! how frequently are we obliged to moderate these vain Pretensions! When we design to be natural and undisguised, we are constrained to acknowledge, that if Nature be so open to our View, as to present us with a noble Spectacle, yet the internal Parts of this Appearance are withdrawn from our Observation. We are unacquainted
with

with the Movement of the Machines; the particular Structure of every Part, and the Composition of the Whole, are Points that surpass our Understanding. We behold the outward Surface, and enjoy it, but the clear and comprehensive Knowledge of the Depths and Mechanism of Nature, is a Favour not accorded to our present State.

We resemble Travellers, who beg in their Journey at the Dawn of a fine Day; a weak, tho' pleasant Light, begins to colour the Objects around us, and we distinguish those, especially, that are near us, and do not confound the River with the Banks that border it: This is sufficient for us, and enables us to continue our Journey. But the Days shines not as yet in its full Lustre.

If we would modestly inquire into the Reasons, why such a small Portion of Light has been imparted to us, we shall find it wisely proportioned to our Necessities, and relative to our present State; and must acknowledge, that had it been more extensive, we should have been less capable of answering the End of our Creation. We are only placed here to be virtuous. Our Reason is dependent on the Senses, by whose Ministration it receives Intelligence of every thing relating to the Life over which it presides. This Reason is subject to a Body, and accompanied with a Set of Limbs: All these Organs have been given it, not for Contemplation, but Labour, and the Performance of proper Actions. These are the Purposes for which we have received it, and they would have been defeated by stronger Illuminations.

A Traveller, in order to proceed regularly in his Way, should be capable of distinguishing the Objects around him, or else he can neither use the one, or avoid the other; but there is no Necessity for him to be perfectly acquainted, either with the Nature of the Land over which passes, or the natural Qualities of the River that flows by him in his Journey; all his Business is to follow the one, and avoid the other. Were he more penetrating and curious, he would stop too long to consider the Particularities of this River; he would be desirous of discovering its Source and first Cause; he would search out the lesser Streams that swell it, and be inquisitive to know the Fish it produced, and the Qualities of the Plants that rise on its Banks; he would be perpetually wandering from Object to Object, and

and his Journey would never be finished. This is a just Image of our Life.

It is true indeed, that the Study and Contemplation of Truth, is necessary for us in this State; and it is highly proper there should be Travellers to discover the Ways and set Marks and Boundaries in Places that are intricate; and likewise that their Discoveries should guide those who come after them: And these are the Benefits we receive from Persons of great Genius, who are appointed for the Conduct and Instruction of others. But Studies which produce nothing, and Speculations intirely barren, and which have no Tendency to improve our Hearts, regulate our Manners, or enrich Society, are Deviations and Amusements unworthy of our Esteem, and are substituted in the Room of necessary Labours. The Deity, by contracting our Faculties, has wisely dispensed with our engaging in these Distractions. Were our Penetration greater, we should be more solicitous to see than to act; and should certainly disdain to creep on the Earth, were it possible for us to behold or know what passes in the Stars.

This Truth will be evidently justified, if we enter into a few Particulars. Let us cast our Eyes on a Husbandman. Such a Person consider'd in a certain Light, and in comparison with others, seems to us an Object of Compassion. He is unpolite, lives a laborious Life, and elegant Pleasures are no part of his Property: He has no Knowledge of amiable Glory, alluring Gold, or glittering Jewels. Has Providence then forgot this Man to lavish his Favours on others? Nothing can be more delusive than such a Point of Sight: What Place does this Person then fill in the Order of Providence? He is ordained for the most necessary of all Employments, the Cultivation of the Earth. He is furnished therefore with all proper Lights, since he has those sufficient for his Station: Had he more, he would not accomplish the Purposes for which he was appointed: If Pleasures and Honour were to present him with any Attractions, he would think himself wretched, in the Obscurity and Fatigues of his Condition; and it is not for his Advantage alone, that his Understanding is gross, and contracted within a scanty Compass, but it is much more for the common Good of Society. Were the Peasant Master of Penetration, Delicacy, and Taste, would he condescend to follow a Flock Night and Day? Would he not find himself degrad-

ed, by the cumbersome and demeaning Cares with which he is obliged to tend these contemptible Animals? And yet, were the Earth and Cattle neglected, all Society would be disconcerted, and intirely destitute of Food and Raiment. The Unpoliteness therefore of the Peasant, is a Benefaction to us; and we discover our Ingratitude and Injustice, when we reproach him for his Stupidity. But our Idea of this Man is applicable to several others. This Man of Labour and Rusticity is the whole Species of Mankind; he is our general Representative. We were all placed on the Earth to cultivate and embellish it, and render ourselves useful by our Labours. The Diversity of Employments requires, indeed, some Variety in the Talents and Lights; but then these Lights and Talents have their Limits, beyond which we are not permitted to pass; and to be desirous of proceeding farther is to have an Inclination to move out of our Condition. To what Purpose is it to dive to the very Bottom of Beings, to unravel the nicest Texture of the Organs of a Body; to inquire how the Vessels that supply it with Life, and which are invisible to our Eyes, can subsist of themselves; to divine what are the Elements of these Vessels, and the first Principles even of those Elements; in a Word, to launch into Infinity itself? We were made for a very different Purpose; and to quit the Truths presented to us, to wander after Informations that elude our Curiosity, in short, to pretend to Wisdom instead of Industry, is to forsake the Path of Virtue which is open before us, and to strike out new Tracts wherein we are interrupted at every Step, by insurmountable Difficulties. 'Tis to resist the Order established by Wisdom itself, which shines bright enough to guide us to our Welfare, but, as yet, has not dissipated all the Shadows; and when it had even added Revelation to Reason, its Intention was to clear up those Doubts we may entertain, with respect to the way in which we ought to proceed, and not to lift up the Vail that deprives us of the true Knowledge of Things. That Period is not yet arrived.

But if it be very just and necessary to be sensible of the Insufficiency of Reason in certain Points, and to submit, without repining, to the Law of him who has regulated all things according to his own good Pleasure, it is still

still equally just to know the Value of this Reason, and exercise it according to its Extent and Ability. Next to Faith, which without Reasoning informs us of what we are to believe, practise, and hope for, we are possessed of no other Treasure more precious than Reason. If this does not penetrate to the very Depth and Nature of Objects, it is at least sensible of their Excellence, and qualifies us to consider them without Confusion: It beholds their Exterior, and is conscious of their Operations and Effects; it discerns their Relations and Number; their Agreements, Properties and Usefulness: In a Word, if it be not furnished with very clear Ideas, it however has distinct Perceptions which it improves to a wonderful Advantage: It enjoys its Privileges, and acts with the Precaution of a Traveller, who, as he passes along, takes notice of what is peculiar to every Country, and knows the Roads, the Inconveniences and Accommodations; and without stopping at any particular Place, observes and makes use of the Whole.

To have a fuller Conviction of the Excellence of our Reason, and the strict Obligation we are under, of improving it to all possible Perfection, we need only compare it with what we have most active and accomplished on Earth, and consider the Rank it holds there, and the Functions it performs. When we examine the various Animals with which Nature is universally peopled, we discover in them all a certain Industry and just Precaution, in the means they choose for nourishing and rearing up their Young. They have an Imitation of Reason, because all their Actions tend to a particular Point; and we cannot mistake in them, the Operation of an infinite Wisdom and Power, which has varied their manner of Life, and imprinted on each Species a Method of proceeding which is never disconcerted: However, we are not to suppose them possessed of Understanding, since they are intirely destitute of Reason. That Wisdom by which they act, and which directs their Motions, resides elsewhere: If they had it in themselves, if they thought and reasoned, we should not see them embarrassed, stupid and intractable, when taken out of the way of Life which is peculiar to each Species. If a Spider had all the Skill of a Weaver, she would make something else beside her Web. Were the Swallow as skilful as a Mason, she would build with other Materials than Mortar. Were

Animals once capable of Thought, they would not be limited to one invariable Track, and new Ideas would be infused into their Minds. The Principle of Reason would not be unfertile in them, but would discover itself by an Air of Curiosity; by new Efforts, and new Works; and the Variety of their Thoughts would not fail to diversify their Industry. It is quite otherwise, with respect to the Industry of Man; he has not received, like other Animals, an Impression of Hability and Vigour, for producing an uniform Operation, by proportionable Organs. The Reason of Man is an active and fruitful Principle, which knows, and would be perpetually enlarging its Attainments; which deliberates, wills, and chooses with Freedom; which operates, and, if I may use the Expression, daily creates new Works. Reason has even enabled Men to imitate the Fabrick of the World, in a Sphere that regularly exhibits its Movements and Revolutions, and this Faculty procures to him something still more beneficial and noble: It makes him acquainted with the Beauty of Order, to the end it may be the Subject of his Admiration, and that he may relish and observe it in all his Performances. He can even imitate the Deity, and his Reason renders him the Image of that Deity upon Earth.

It not only makes him acquainted with the Exterior, the Beauty and Value of every Object, but likewise gives him the real Enjoyment thereof. It is this Reason which constitutes him the Master and Monarch of all the Earth, and acquires him the Possession and Sway of his Empire.

'Tis true, indeed, Man is not invigorated with the Agility of Birds, who are every Moment wafted by their Wings to a large Distance. He is not fortified with the Strength of those Animals, who are armed with Horns, strong Talons, and destructive Teeth; much less is he array'd, like them, by the Hands of Nature; he neither comes into the World with Furs, or Plumes, or Scales, to defend him from the injuries of the Air. Does such a Destitution comport with the Lord of the Earth? But he has received the Gift of Reason, and is therefore rich and strong, and plentifully accommodated with all he wants. This informs him, that whatever Animals enjoy, 'tis all for his Use; that in Reality they are his Slaves; their Lives and Services are at his Disposal. Is he desirous of Game for his Regale? He dispatches his Dog or Falcon, who are trained up for

that

that Purpose, and, without any Trouble of his own, he is accommodated with all he wants. Would he, in one Season, change the Habit that clothes him in another? The Sheep resigns to him her Fleece, and the Silk Worms spin, for his Use, a more light and gorgeous Robe. The Animals sustain him, and keep Centry at his Door; they combat for him; they cultivate his Lands, and carry his Loads.

Nor do the Animals alone lend him their Agility and Vigour: Reason makes the most insensible Creatures contribute to his Service; it causes the Oaks to descend from the Mountains, and forces the Stones to start from their Quarries, to furnish him with an Habitation. Would he change the Climate, cross the Seas to distant Lands, and either carry any of his Superfluities thither, or bring back from thence what he wants? He makes the Mobility of the Waves and Winds subservient to his Designs. Reason places the Elements and Metals in Subjection to his Necessities; and every Object around him is submissive to his Laws.

As inconsiderable as he is in Bulk, his Reason furnishes him with a Power, which is only bounded by the Earth he inhabits; his Desires are accomplished at each Extremity of the Globe; and, if I may use the Expression, he brings these together when he pleases, and establishes an Intercourse between them, without stirring from his own Habitation. He paints his very Thoughts in Writing, and his Letters, without any Trouble to him, are circulated through Nations and intimate his Will to a People three thousand Leagues distant from him. He corresponds with the whole Earth, and after his Death, is even capable of entertaining the latest Posterity. It is impossible to pursue Reason through all her Wonders; she enriches and adorns every State, and I think her as admirable in the Fingers of Artists, where she proves a Source of Beauties and Accommodations, as she is in the Discourse and Writings of the Learned, where she appears an inexhaustible Treasure, as well of Instructions and Relief, as of Consolation and Pleasure.

To such valuable Productions and precious Advantages Reason joins a Set of Privileges that still ennoble her the more. She is the Centre of the Works of God on Earth; she is their End, and constitutes their Harmony. Let us take Reason but a Moment from the World, and suppose Mankind destitute of her Influence; all Union would cease to subsist

among the Works of the Deity, and a general Confusion be introduced through the Whole. The Sun enlightens the Earth; but this Earth is insensible, and wants none of that Lustre. The Rains and Dews, aided by the Warmth of that amiable Orb, give Vegetation to the Seed, and cover the Fields with Harvests and Fruits; but these are all lost Riches, and there are none to gather or consume them. The Earth, I confess, will nourish the Animals; but these Animals are insignificant, for want of a Master to exercise their good Qualities, and concentrate their Services. The Horse and Ox have Strength sufficient to enable them to draw or carry very weighty Loads; their Feet are armed with Horn, capable of resisting the most rugged Ways; but they neither needed so much Force nor so strong a Horn, to qualify them for grazing in the Meadows where they seek their Pasture. The Sheep is charged with the Weight and Impurities of her Fleece, and the Cow and Goat are incommoded with the Redundancy of their Milk. Disadvantage or Contradiction reigns through the Whole. The Earth incloses in her Bosom Stones fit for Building, and Metals proper for the Formation of all Sorts of Vessels. But she has no Guest to lodge, nor any Workmen to employ these Materials. Her Surface is a spacious Garden, but not beheld by any Spectator; all Nature is a charming Prospect, but afforded to none. Let us restore Man, and replace Reason on the Earth; Intelligence, Relations and Unity will immediately reign through every Part, and the very Things which did not seem created for Man, but more immediately for Plants or Animals, will have some Relation to him by the Services he receives from those Animals and Plants. The Gnat deposits her Eggs in the Water, and they produce a Species of Vermin that live a considerable Time before they inhabit the Air, and are the usual Sustenance of Fish and Water-fowl. All these are made for Man; 'tis therefore to his Advantage that Gnats should exist. In the same Manner he approaches all other Beings. His Presence is the Band that connects such a Variety of Parts into the Whole; and He is the Soul by which they are animated.

In a Word, Reason not only renders Man the Centre of the Creatures who surround him, but likewise constitutes him

him their Priest: He is the Minister and Interpreter of their Gratitude; and it is by his Mouth that they offer their Tribute of Praise to him who has formed them for his Glory. The Diamond is neither acquainted with its own Value, nor knows from whom it received its trembling Lustre. Animals are ignorant of him who clothes and sustains him. The Sun himself is insensible of his Author. Reason alone discovers him; and as she is placed between the Deity and Creatures of no Understanding, she is conscious that in using these Creatures, Gratitude to God, Adoration and Love are incumbent on her. Without her Presence all Nature would be mute; but by her Mediation, every Part of it proclaims the Glory of that Being from whom they received their Existence and amiable Qualities. Reason alone is sensible she is in his Presence; she alone knows what she receives from his Bounty, and enjoys the inestimable Happiness of being able to adore him, for all that is either in or around her; and as there is Reason upon Earth, consequently there ought to be Religion, and Man should be devout in Proportion to his Rationality. It is apparent that his Religion is only weak, according as his Reason is sunk and perverted; which always happens when he obstinately desires Attainments that surpass him, or neglects to enrich himself with what was intended for his Instruction and Exercise.

This, my dear *Chevalier*, is a slight Sketch of the Advantages and Prerogatives of Reason; and they are doubtless so considerable, that Man, far from having any Cause to complain of his Condition, ought to be surprised at the prodigious Variety of Informations and Productions he is capable of accomplishing. And the more sensible he is of the Dignity and Excellence of Reason, the more he perceives the Necessity of cultivating and improving it: But the capital Point, wherein this Cultivation consists, is to be constantly exercising our Faculties on Objects suited to their Power, and which make us better and more happy.

Let us judge of our proper Behaviour on a thousand Occasions, by that which we ought to observe in a single Instance. Nothing is more lovely than the Light, nothing more worthy to exercise our Understanding than that Object which gives Beauty to all Nature. Let us inform our-

selves at least then, of one Part of what may be known of it, and especially of what may be known to Advantage. But to make the Thing more intelligible, we shall use a very familiar Image.

I find myself in a Stage-Coach with two Philosophers, whose Sentiments are almost diametrically opposite. We will suppose our Journey began long before Day, and that all the intervening Time was passed in Sleep or Dissatisfaction; but at last the Dawn appears, and we are all awake: Some Reflections on the inestimable Benefit of Light and Colours create a Dispute between my two Philosophers, and give them an Opportunity of reasoning on the Nature of Light: One pretends, not only to explain what it is in itself, but likewise our own particular Idea of it. His Adversary finds both the one and the other unintelligible, and concludes with observing, that Man in his whole Extent is not above six Feet high, and yet fancies he has a real Idea of an Altitude of ninety or a hundred Feet; of the Extent of a Plain, or the Distance of the Stars from our Earth. From whence he observes, that it being a manifest Absurdity to affirm one can have in himself, the real Idea and Measure of an Object by which he is exceeded in Dimensions, it must consequently be impossible to see, and that there is no Reality in Vision; that every Thing is absurd and uncertain, and that he himself is not even sure, whether he is in our Company or not, in the Coach. I listen to them both, and when the Warmth of the Argument is a little abated, they appeal to my Decision. Gentlemen, say I, permit me to acquaint you with my Sentiments without Reserve. The Discourse began with enumerating the Advantages and Use of Light and Colours; and you turn your Eyes from a plain Question, whose Solution is very obvious, to cast them on two Labyrinths of Difficulties immaterial to the present Affair.

One of you, being accustomed to hesitate on no Point, pretends to explain the Nature of Light, and the Idea we entertain of it; the other habituated to doubt of every Thing, is not even certain he sees the Day. One would know what in all Probability is concealed from us; the other would be ignorant of what we really perceive. Let us observe a Medium, and endeavour to know and improve what

what we have in our Power, instead of pursuing what is forbidden, or suffering what we possess to remain useless. What would you think Gentlemen, of two young Apprentices to a Clock-maker, who having received from their Master Brass and Tools to make a Wheel, should spend the Day in disputing on the Nature of the Metal put into their Hands? Light and Colours which are the Subject of your Dispute, were intended to conduct us, and not be the Matter of our Disquisitions and speculative Disagreements. We would willingly penetrate into all its Properties, because we find ourselves curious; or else deny its Existence, because the Nature of it appears incomprehensible. These are two Extremes equally discommendable. Let us therefore enjoy Light and Colours, without making too deep Researches after what they are in themselves; or if we have an Inclination to reason on that Subject, let it be proportioned to our Capacity, and always with a View of some new Advantage; and so without knowing the Nature either of Light, or the Glass through which its Rays are transmitted, we may make the Glass, and modify the Passage of the Light in such a Manner as to assist the weakest Eyes, cause the most distant Objects to approach us, and magnify those whose Minuteness makes them shrink from our View.

This is a laudable Manner of exercising our Understanding and Hands with regard to Light: Or, if we will confine our Minds to Speculations and Reasonings, let us choose such as may enrich that Faculty with some undeniable Truths, capable of improving us by affording better Informations, and making us more affected with what we have received.

For Example, if we only consider the Use of this Light, which was the Point in Debate between you, is there not a visible Design in it, a charming Grandeur and Beneficialness? A Moment ago, all Nature was plunged in Darkness, and every Object was dead to us, because the Gloom deprived us of their Use: But the Re-appearance of Light in some Measure raises Nature from Annihilation, and restores its Benefits to Mankind.

But this alone is not sufficient to make Objects distinguishable; were they all of the same Complexion they would be confounded by the Eye; but you see they are

clothed with a Livery or rather bear a Ticket, that renders them distinct; and by their Surfaces easy to be distinguished and perceived, which saves Mankind the Labour of long Searches, and the Uncertainty of those Reasonings he would otherwise make on their various Natures, that he might not confound them: With Respect to the Variety of Colours, some are soft and friendly to the Eye, particularly green; others melancholy and languishing, as brown and black; some lively and dazzling, as white and red: And if large Quantities of these two last Colours had been shed over the Surface of the Earth, our Sight would have been fatigued. Did Black frequently make its Appearance in Nature, it would have arrayed her in Mourning; but let Green be generally unfolded, the Eye will be aided and refreshed, without our knowing the Reason; and therefore we see that the same Creator who formed the Eye, has diffused over Hills and Plains, and all Nature around us, that soft and smiling Verdure, which is so accommodated and convenient to the Sight, and yet, that he might not by too universal a Green defeat the general Intention of distinguishing Objects, I observe that the Verdure of a Meadow differs from that of sowed Land; that every Tree and Plant has its peculiar Tinge, and the Shadings of the same Colour diversify in such a Manner the Habit given to each Body, that they are all known and easily distinguished.

These are the first Thoughts that occur to me on the Subject of Light, and by which I endeavour to reclaim my Travellers from Presumption and Uncertainty, to plain and palpable Truths; and such are those which are presented to us in all we see, provided we constantly confine ourselves to what is simple, beneficial, and necessary; equally avoiding the Extremes of perpetually creeping, when we have Wings to raise us, and immoderately soaring, when we are once aloft.

All that has been said may be reduced to a Maxim, easily retained and practised. With Respect to all created Things that rise to our View, there are but three Particulars wherein we can fix a Determination: One must be, a Resolution to know nothing; the second, a Desire to comprehend the Whole; and the third, an Inclination to search after

after and improve to the best Advantage whatever we are capable of knowing. The first Determination is a Piece of Indolence that runs into mere Stupidity; the second is a Temerity which is constantly punished, and the third is a Resolution of Prudence, which, without aspiring to what surpasses the Capacity of Man, is exercised with Modesty, and gratefully uses what was made for our Enjoyment.

I am, &c.



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